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Goldfield and Its Present Boom

By H. C. Cutler*

SYNOPSIS—The prediction of optimists that a second boom, of greater force than the first, was sure to occur, now seems about to be fulfilled. Based on the strike of high-grade ore in the Jumbo Extension mine, the camp is expecting more discoveries in other properties. Stocks are experiencing sudden inflation in value, and the beginning of an excitement appears to be at hand. The present article reviews the established theories of the Goldfield geology, correlating it with more recent studies and the new ore discovery.

The long-expected has happened. For a number of years, in fact ever since the decline of the last boom, optimists have been predicting a second boom for Goldfield. They based this prediction on nothing more tangible than the fact that some of the other great gold camps, particularly Cripple Creek, had a second boom of greater intensity than the first. The recent strike of high-grade ore in large quantities in the now famous Jumbo Extension property furnished the necessary incentive for the present excitement.

At first it was quite hard for those who had stuck in Goldfield, in spite of their slogan "If you stick you will win in Goldfield," to realize that the present discovery was anything more than a small bunch of ore, and they believed it was only a question of a short time when it would "peter" out. But as the orebody continued to increase in size and value, it gradually dawned on them that here was the material to start the long-looked-for revival. The discovery was in new ground, apparently not connected with the known system of oreshoots, and it gave prospective value to a large amount of territory hitherto not deeply prospected. When the orebody passed from the latite to the latite-shale contact and was larger and richer than above, the news was spread broadcast and a large number of the "oldtimers" who had left the camp when it declined and spent their money in other places, began to return to share in the golden harvest about to begin.

A New Period of Activity

At the time of writing the boom is on full blast, and people are coming in from all over the country. The stock market, with Jumbo Extension as a leader, is in a furor. Old stocks, hidden away in trunks and pigeonholes and long forgotten, have been resurrected and in many instances turned into money at the present market prices. Various tales are told of persons who have dug up these stocks and turned them over for amounts of money sufficient to last them for the remainder of their lives. Of course, these tales grow with repetition and the effect is to excite the public. Maps of the Goldfield district, which have received but scant attention during the past few years as they hung on the walls, are now at a premium. The large one that hangs on the wall at the Goldfield Hotel is constantly surrounded by crowds eager to find open ground or trace the course of the new oreshoot. Copies of Ransome's report on the Goldfield dis-

Town of Goldfield and the Surrounding Country

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trict, now out of print, are eagerly sought by visiting engineers, and geological papers and articles published in the past are carefully read for some clew to present conditions. Is there after all a substantial basis for all this excitement? I believe there is, at least for a part of it.

F. L. Ransome's report, "The Geology and Ore Deposits of Goldfield, Nev.," issued by the U. S. Geological Survey, is excellent. It is the result of a careful study of the district, and his geological conclusions have been borne out to a great degree. I believe that the development work done in the past few years on the lower levels of the various mines has made clear some of the puzzling problems which Ransome encountered, and that it is now possible to formulate a theory supported by facts that will give a clear idea of the formation of the ore deposits. I do not intend to go into a technical discussion of the various rock flows, the geological sequences, or the processes of alteration and ore deposition with all the attending features, since this has been thoroughly covered by Ransome's report and other articles in the past few years. I intend merely to give a broad outline covering the structural features: the formation of the fissures now occupied by the ore deposits, and to correlate the facts already ascertained by Ransome, Locke, Byler and others.

Recent Study of Geological Features

E. A. Byler has been in Goldfield continuously since its discovery and has studied the various features of the geology carefully. By means of a glass model, constructed by himself, he has noted the detail features of the geology as they were developed by the numerous shafts and other openings, and his ideas have already been expressed.[1] All of the geologists who have studied the problem suggest a relation between Columbia Mountain fault and the mineralization. Ransome, in his report, terminates this so called Columbia Mountain fault at the Conqueror mine on the north and the Red Top mine on the south. Byler has extended it beyond the Florence on the south and to an east and west fault, extending westerly from Diamondfield on the north. The different dips of this fault, varying from 20° to 55°, have been puzzling and this in itself suggests that there have been several different movements.

Ransome concludes that the greater part of the total movement was prior to the dacite intrusion while Locke, touching lightly on this faulting, concludes that the main part of the movement was later. Byler agrees with Ransome. Correlating the known facts concerning the dip, we find that, in the immediate vicinity of Columbia Mountain, and where it is contiguous with it, the fault has an easterly dip varying from 50° to 60°. Toward the west, in the vicinity of the Conqueror mine, it flattens to 20° to 25°, still dipping to the east. Through the dacitic area south of the mountain the fault is irregular both in strike and dip, and has apparently dissipated itself into innumerable fractures which in the main dip easterly, from 30° to 55°, and even steeper. Upon passing into the latite, a general dip of 30° to the east is encountered and this seems to persist to depth.

Byler says: "The fault zone, shown in this section on its dip, corresponds approximately to sloping fault-contacts of dacite with latite, and latite and shale, and at deeper workings probably the fault contact of shale with alaskite. The downward throw on the east side of the fault has not been sufficient in amount to allow the approximately horizontal layers of latite and shale entirely to pass their corresponding layers on the west side. Therefore, the fault zone in places passes through latite upon both sides, and similarly through shale. In consequence of the dacite intrusion across this fault along a portion of its length, which practically obliterated it to a depth of about 300 ft., it follows that the relative position of the geological formations caused by the fault do not properly show above or at this intrusion, though they do below it.

After the dacite intrusion there has been a further small movement along this fault zone, and where the intruded dacite lies across the upward extension of the zone, no preëxisting fracture is present, and the movement, while following the extension in general, has been recorded in irregular fractures extending up to the surface having a steeper dip, and connecting below with the fault as shown in Fig. 6. The mass of eruptives and solidified dacite intrusion has settled irregularly, due to the additional movement of the fault in its original position below, and we consequently find many irregular fractures extending from this fault zone to the surface. These fractures connect below and finally merge with the original fault zone, the foot wall of which in effect forms the foot wall of the mineralization."

Ransome's Description of General Geology

We find that no matter what dip these various fractures have at or near the surface, at a depth of about 300 ft. they merge into the main fissure, with an easterly dip of 25° to 30°. This at least is true of the places exposed by the workings in the productive area. It is hard to conceive of an upthrust, or block fault, showing a slipping of the rock layers on the fault plane having such a flat dip as 25°. This movement has more of the appearance of faulting under a tension, a pulling apart of the rocks, rather than a shearing, such as we would have with an upthrust. This part of the faulting movement seems to be entirely separate from the movements caused by Columbia Mountain. Ransome's description of the general geology of the district suggests a solution of the question. Quoting from his report: "The structure of the Goldfield district, as previously stated, is broadly simple. A Tertiary volcanic series resting upon the worn surface of much older rocks has been elevated into a dome of gentle curvature, and this after some modification by faulting and igneous intrusion has been truncated by erosion so as to denude patches of the fundamental formations. This structure was afterward covered, at least in part, by flows of lava which have in their turn been eroded from all but the outlying parts of the district. Banner Mountain may be taken as the approximate center of the uplifted area. The uplift, however, is not symmetrical, and Vindicator Mountain appears to correspond structurally to a local protuberance on the dome. . . . The symmetry of the dome is further modified, as will later be shown, by irregular intrusions of the dacite and by the Columbia Mountain fault."

The consensus of opinion, deduced from a correlation of the facts, is that this uplift occurred some time after the out-pour of the Milltown andesite and before the intrusion of the dacite. The effect of this uplift would be twofold. It would tend to break up and disrupt the flows

[1] "Min. and Sci. Press," July 12, 1913, p. 959.

directly over the highest point of uplift, and, producing a tension at a certain radial distance from the center, cause a breaking and in many places a slipping of the rocks, or in other words, an approximately circular tension fault. This line of faulting corresponds closely with a circular line drawn through Ransome's area of alunitic alteration as shown in Fig. 1 (after Ransome). I do not believe that there was actual faulting around the entire circumference, but in the absence of faulting, there would be a crushing and fissuring of the rocks sufficient to produce a condition favorable to ore deposition. This faulting and breaking probably extend to great depths and connect with the source of the mineralizing solutions, furnishing a path of easy access to the surface. It is entirely probable, judging from the character of the ore deposits, that at this time and before the intrusion of the dacite, the formation of the orebodies began, and as a result we have those of the Black Butte, McMahon Ridge, Sandstorm and Kendall and possibly the lower end of the Mohawk series and the large orebody recently discovered in the ground of the Jumbo Extension company.

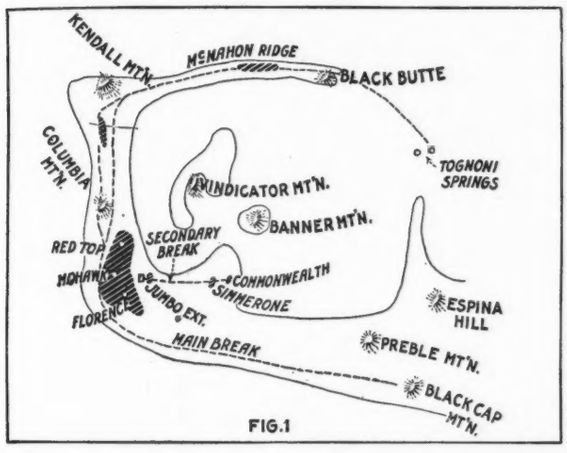

FIG.1

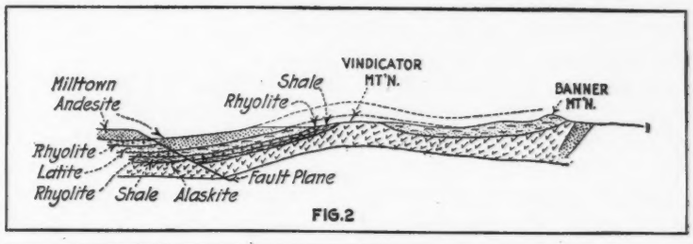

FIG.2

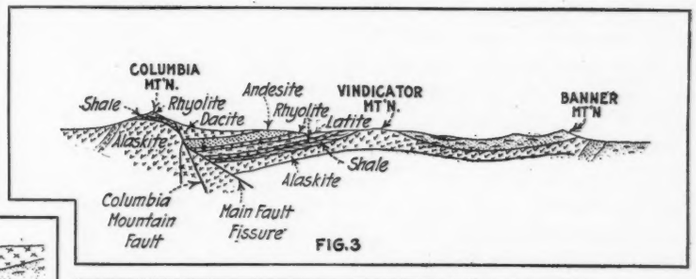

FIG.3

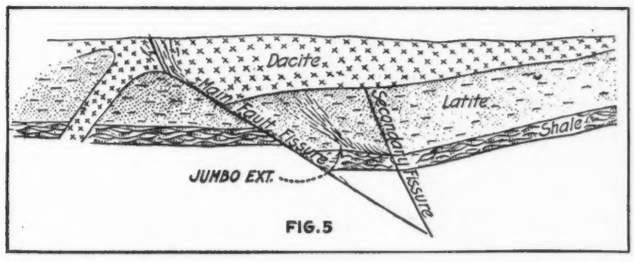

FIG.5

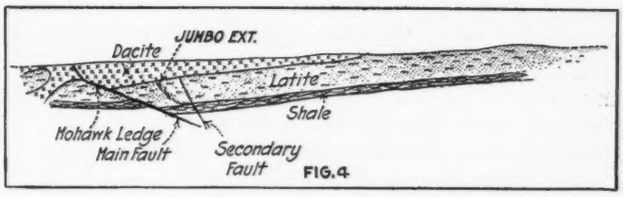

FIG.4

ILLUSTRATIONS OF GOLDFIELD GEOLOGY

In a disturbance of such magnitude as this it is inconceivable that there resulted just one distinct fissure plane. During the time of formation of this one main fissure there must have been formed innumerable smaller fissures and cracks, some superficial and of no great extent, others larger and connecting in depth with the main mineralizing break. This latter condition, I believe, is what exists on the Jumbo Extension ground. The orebody is largely confined to the latite and the latite-shale contact. The dacite coming later over the latite practically sealed this surface and arrested the free flow of the solutions and stopping the ore deposition at this time.

SEQUENCE OF CORRELATED EVENTS

The general sequence of events which bests correlates with the facts as ascertained is as follows: (1) The deposition of the Tertiary rocks up to and including the Milltown andesite, on the old pre-Tertiary floor; (2) the domical uplift, with Vindicator and Banner mountains as the center of the dome, and the formation of the main fault fissure around the circular edge of the dome corresponding to a circular line through Ransome's area of alunitic alteration; (3) the first era of mineralization, aided by more or less continuous movement along fault plane, caused by readjustment; (4) the intrusion of the dacite, following the structural line of weakness, extending around the edge of the dome from Columbia Mountain to Black Butte. According to Byler there seems to

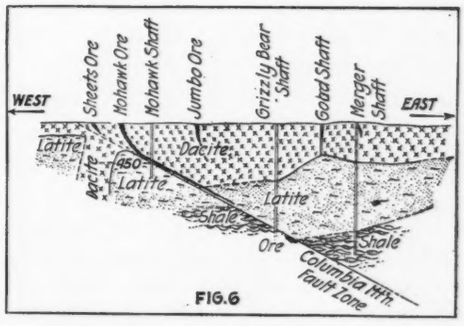

FIG.6

be considerable evidence that the dacite exists as a dike, at least for a large part of this distance, and that the dacite now exposed is partially intrusive and partially effusive (this, I believe, is also Ransome's idea); (5) the upthrust of Columbia Mountain, causing the Columbia Mountain fault. This fault is clearly defined and has a steep dip to the east where it is in immediate contact with the mountain. South of the mountain and through the known main productive area of the camp, the movement of the faulting dissipated itself in breaking and fissuring the body of dacite. The fault connects in depth with the main fault fissure caused by the domical uplift. The surface breaks in the dacite were irregular both in dip and strike, and extended into the Milltown andesite beyond the Florence. This breaking of the dacite, together

with the breaking caused by the cooling of the mass, made of the dacite along this line of movement a porous mass, the so called sponge described by Ransome; (6) the resumption of the flow of the mineralizing solutions. With the dacite covering shattered and broken over the area outlined above, the mineralizing solutions from the main fault fissure found ready access to the surface and circulation was renewed. The large dacitic orebodies of the Red Top, Mohawk and Combination and the andesite orebodies of the Florence were formed. Some slight post-mineral faulting occurred later which modified the position of the orebodies somewhat. In general, the ore deposits formed in this part of the district have followed down the breaks in the dacite to the main fissure, down this fissure through dacite and latite to the latite-shale contact, then down the trough formed by the fissure and shale into Atlanta ground, and no doubt at some point still deeper they will pass into the alaskite.

It is impossible to correlate the new orebody of the Jumbo Extension in its upward extremities with the main ore-zone of the Mohawk and Florence group. The bunches of ore occurring in the dacite above the main orebody are disconnected and do not coincide with any extensions of orebodies to the west. Upon entering the latite the vein or orebody becomes better defined with a northwest and southeast strike and a dip to the northeast. Down through the latite to the shale the deposit increases in size and distinctiveness until at the latite-shale contact its proportions are large and the value of the ore in gold, silver and copper high. The contact dips slightly to the northeast and the rake of the oreshoot is to the east.

Secondary Break as Mineral Resource

As stated before, I believe the immediate source of this mineral is a secondary break striking nearly east and west and extending from at least as far west as the Clermont claim and to the Commonwealth mine on the east, and connecting in depth with the main mineralizing break. I have indicated this break in Fig. 1, which is taken from Fig. 19 of Ransome's report. The evidence that this break exists is deduced from superficial examination. Its course is indicated on the surface by a gulch following quite closely the course shown on sketch. In addition to this we find small surface exposures of ore in the dacite following this gulch line, the significance of which will be explained later. Near the western end was the bunch of high-grade oxidized ore found on the Velvet claim almost directly above the present orebody, which yielded about $11,000 in 1907. Some ore was found on the Spearhead claim east of this point. Still farther east and on the Cimarron claim a small pocket of oxidized ore yielded between $5000 and $10,000. East of the Cimarron on the Commonwealth property, bunches of rich ore were found on the surface and to a depth of 100 ft. Across the gulch, on the Lone Star property from $15,000 to $20,000 of ore was extracted at or near the surface.

In the mining of this ore, it was impossible to follow the downward extension of the "pay crack." The reasonable explanation of this seems simple. The larger part of the mineralization from this secondary break took place before the intrusion of the dacite, in the latite and on the latite-shale contact. After the intrusion of the dacite the latite surface was sealed and the circulation of the mineral solutions stopped. As this part of the district was too far away to be affected by the Columbia Mountain uplift and not in line with the faulting, the breaking up of the dacite was slight. The porous mass, likened to a sponge, was missing, and ore deposition slight. The small ore deposits enumerated above were formed in small cooling cracks in the dacite, which connected through small seams with the break in the latite below. These small seams as they were formed allowed a very slight resumption of circulation of the mineral solutions. I believe that intelligent prospecting along the line of this indicated secondary break will very likely be rewarded by the exposure of other oreshoots. I also do not believe that this is the only secondary break connecting in depth with the source of the solutions. Prospecting will probably disclose others.

With the discovery of the large body of ore on the latite-shale contact, this contact has assumed too great importance in the public eye. It must be remembered that ore occurs in a very small portion of the dacite, latite and andesite formations, and that other conditions are necessary for its deposition. This is just as true of the latite-shale contact. This contact has been exposed in a number of places in the district and no ore found on it, and great care must be exercised by the investing public in placing their money where they at least have a chance.

I believe that the chances of discovering further ore in depth in the andesitic areas of McMahon Ridge and Black Butte are good, and it is quite possible that there are other places along the circular break that are mineralized and will stand intelligent prospecting. The effect of the present discoveries will be to stimulate work along these lines.

More or less familiarity with the geology of the Goldfield district as described by Ransome, Locke, Byler and others is necessary to understand the outline of the above theory as I have gone into but little detail. Fig. 1, after Ransome, gives an idea of the general circular break with Banner and Vindicator mountains as approximate center. The dotted circular line is only an approximation of the course of the main break and follows closely Ransome's area of alunitic alteration. Its actual course is masked to a large degree by the dacite intrusion. This area is no doubt the result of the circulation of waters through the main fissure, both from above and below. The secondary break is shown by a dotted line extending from a point east of the Mohawk shaft to the Commonwealth mine. The strike of this is assumed along the gulch line connecting the two points. The dip is problematic. Fig. 2 is a section through Vindicator and Banner mountains and represents the approximate position of the various rocks after the domical uplift and erosion at the highest point, and shows the faulting plane on the western edge.

Fig. 3 shows how this was further modified by the intrusion of the dacite and the upthrust of Columbia Mountain. The main fault fissure, instead of extending to the surface, is cut off by the dacite and the Columbia Mountain fault, as indicated in the sketch.

Fig. 4 after Ransome, is a cross-section through the Mohawk shaft showing the Mohawk ledge and the approximate position of the secondary break with reference to the main fault fissure and the Jumbo Extension ledge. The dip of the secondary break is entirely assumed. Fig. 5 is a portion of 4 enlarged. Fig. 6 is a copy of Byler's Sketch 1.

Designing Small Copper Smelting Plants

By Charles C. Christensen*

SYNOPSIS—Small smelting plants have been the means of developing important mines. The design of copper-smelting plants, ranging in capacity from 30 to 200 tons, is considered in this article.

The rôle of the small smelting plant has been an important one in the development of some of our great mines. While times have changed its importance in certain parts of this country, the small furnace is still accomplishing excellent results in the developing of small but rich properties, especially in countries where the transportation facilities are meager, as in certain parts of Mexico, Peru, Chile, and other Latin-American republics. The assistance of a consulting engineer or metallurgist is not always sought in the installation of small smelting works. A few remarks covering the main features of these small plants may therefore be of interest.

Experience in copper smelting has taught that 1 sq.ft. of area at the tuyere line of a furnace will smelt from four to six or seven tons of charge per day; about four tons for small circular furnaces, five tons for small rectangular furnaces, six tons for the larger rectangular furnaces, and up to seven tons for the extremely long furnaces. Of course, the nature of the slag made and the character of the ore might be such that a greater or less amount would be smelted, but under ordinary conditions the foregoing figures may be taken as representative.

In the design of small works, the distance from transportation and manufacturing centers must determine the number of spare parts to be ordered at the time of preliminary installation. The size of plant will also determine, to a great extent, whether assaying and sampling equipments are to be provided. At some properties assay equipment will have been installed before a smelting furnace is considered. Probably not many properties will have sampling equipment, but in this department the equipment is largely determined by the individual preference of the superintendent, so that aside from the mention of the standard Snyder, Vezin and Brunton samplers, it is hardly worth while to discuss in detail the sampling equipment. Frequently, the metallurgist in charge has to improvise a sampler; or it may be that the mine ore is sufficiently regular to depend on the mine sampling, or as frequently happens in emergencies, sampling must be dispensed with and the furnace run entirely on physical criteria.

The plants to be considered in the succeeding remarks range from a daily capacity of 30 to 200 tons, and as these small installations are usually in isolated places where electric or water power may be developed, no description will be given of steam power plants. The plants under consideration will be beltless plants, electrically or water-power driven.

Small Circular Water-Jacketed Furnace

Design of a 30-Ton Plant

A plant of 30-ton capacity naturally predicates a rich ore, as the expense of operation will be much higher per ton than in a larger plant. The operation of a small furnace also means more "grief" for the operator in keeping his furnace going than probably occurs in the running of a well regulated plant of 1000-ton or even 10,000-ton capacity.

Following the rule already mentioned in regard to the tuyere-line area necessary for a given capacity, we have for a 30-ton charge per day the following calculation: $\frac{30}{4} = 7.5$ sq.ft. The desired hearth area would thus be found in a standard 36-in. round furnace such as shown in the accompanying illustration. Its capacity is likely to be lower than the amount mentioned, as small furnaces will only develop this speed when smelting a very favorable charge. It should also be noted that capacities mentioned refer to tons of charge, not ore; the ore smelted by a given furnace must be calculated with reference to the amount of flux necessary to make a charge that will produce a readily fusible slag.

A blower having a capacity of 1950 cu.ft. per min. at 16-oz. pressure would be required, and to operate the blower, a 12½-hp. electric motor. A 40-hp. generator would be provided to run the motor, and a dynamo for electric lighting. A 24-in. Pelton waterwheel would develop about 45 hp. with say 100 cu.ft. of water per minute under a 330-ft. head. A 10-in. pipe line would supply the power plant. If an electric-light plant is not desired, a 12½-hp. generator and a 15-hp. Pelton would suffice.

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Blast Furnace—All iron and steelwork for one round, steel water-jacketed blast furnace, measuring 36 in. in diameter at the tuyere line, complete in details as follows. The bottom of the furnace shall consist of a heavy cast-iron plate resting on four short cast-iron columns; under the bottom of the furnace shaft there shall be hinged drop doors. The water jackets shall be of steel plates with riveted and welded joints, the outside sheet of the jacket shall be $\frac{5}{16}$ in. thick and shall extend down to the bottom plate to form the curb of the furnace; the inside sheet of the jacket shall be $\frac{3}{8}$ in. thick. A sheet-steel windbox encircling the outside jacket shall have six tuyere openings into the interior of the furnace. Above the jacket shall be a $\frac{3}{16}$-in. sheet-steel hood of conical shape provided at the feed-floor level with an opening for charging the furnace. The hood is to terminate in a sheet-steel stack passing up through the roof of the building.

Forehearth—There shall be provided a matte-settling pot, 36 in. in diameter, mounted on wheels, to act as forehearth.

Slag Pots—Six cast-iron 2-cu.ft. mounted slag pots, the wheels of which shall be provided with roller bearings.

Furnace Tools—There shall be provided four standard steel-charging barrows with roller-bearing wheels; four No. 7 wheelbarrows; four No. 2 scoop shovels; four long-handled square-point shovels; four sledges with handles, two each 6-, 8- and 10-lb., respectively; 600 lb. assorted sizes of furnace bars; one six-beam charging scale; six 24x24-in. cast-iron doors and frames (in case a brick dust chamber is deemed desirable); a four-section matte pan, each section to be 4 ft. 6 in. wide by 2 ft., by 3¼ in. deep.

A 50-Ton Smelting Plant

For smelting 50 tons of charge per day, the hearth area required would be as follows: $\frac{50}{4}$ = 12½ sq.ft.; thus a 48-in. round furnace would meet the requirements. The amount of air required by the blast furnace may be found by the following rule: 260 × hearth area in square feet = cubic feet of air needed per minute. Applying the rule: 260 × 12½ = 3250 cu.ft. of air per minute, for which a standard 13-cu.ft. positive-pressure rotary blower would be ordered; this would be operated at 250 r.p.m. and deliver air at 16-oz. pressure.

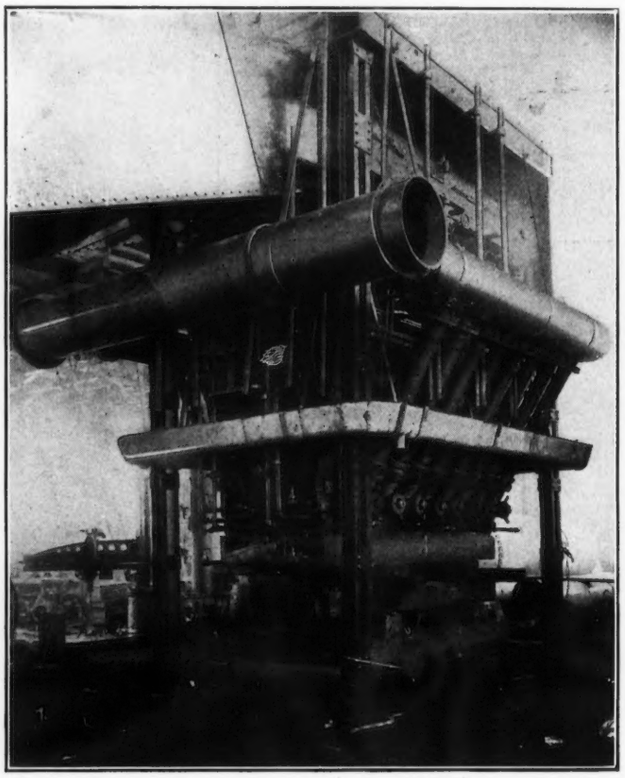
Power to run the blower for the 50-ton furnace would be figured as follows: $\frac{3250}{1000}$ = 3.25 × 5 + 10% = 18 hp., for which a 25-hp. electric motor would be provided. The dynamo for an electric-light plant, with transmission losses added, would bring the power requirements up to 62½ hp., say a 65-hp. generator. Adding for loss in the generator and gear friction, 77 effective horsepower must be delivered by the waterwheel. Assuming a 320-ft. head, 650 ft. of No. 12 steel pipe, 12 in. in diameter, and 200 cu.ft. of water per minute, a 3-ft. single-nozzle Pelton wheel would be required; this would deliver about 96 hp. with 187 cu.ft. of water when running at 420 revolutions.

The specifications for the blast furnace and for the accessories would be similar to those for the 36-in. furnace (except that a portable rectangular forehearth, made of 36x48x24x1-in. cast-iron plates, might be provided).

The 100-Ton Plant

To smelt 100 tons of charge per day, a furnace having the requisite hearth area would be $\frac{100}{5}$ = 20 sq.ft. A standard furnace 36x84 in. at the tuyere line would have a hearth area of 21 sq.ft. and would be selected for this capacity. Applying the rule to determine the air requirements, we have: 260 × 21 sq.ft. = 5460 cu.ft. of air per minute. One of the standard positive-pressure rotary blowers delivering 33 cu.ft. per revolution and running 180 r.p.m. should deliver 5940 cu.ft. of free air per minute at 32-oz. pressure. About 5 hp. is usually figured for 1000 cu.ft. of blast for each pound of pressure; therefore, allowing 10% for friction losses, $\frac{5940}{1000}$ = 5.9 × 10 + 10% = 65 hp. To drive this blower an 85-hp. electric motor would be connected by a cut gear and pinion.

To run the blower motor and a dynamo for an electric-light plant, embracing one hundred 16-cp. incandescent lights and four arc lights, 110 hp. will be required; but



A 100-Ton Copper-Matting Furnace Assembled at Factory

15% should be added for loss in motor and dynamo, and 10% for loss in transmission, hence the generator should be capable of developing 137½ hp.; say 140 hp. is needed. Allowing 15% for loss in generator and 3% loss for transmitting power by gear from waterwheel to generator, gives a total of 165 hp. to be delivered by the waterwheel. Assume 360 cu.ft. of water available per minute under 375-ft. head and 650 ft. of 16-in. steel pipe. A 4-ft. single-nozzle Pelton waterwheel, figuring 80% efficiency, would deliver 213 hp. with 358 cu.ft. of water at 370-ft. head. Using a 16-in. pipe line 650 ft. in length, the loss of head by friction would be 4 ft., leaving an effective head of 371 ft., which will give 213 hp. with 358 cu.ft. of water per minute, running the waterwheel 339 r.p.m. The maximum pressure in the pipe line will be 370 × 0.433 = 160 lb. Figuring a tensile strength of 60,000 lb. for the steel plate, a factor of safety of 3¾ and for

double-riveted lap joints 0.7 efficiency, the following rule will give the thickness of plate required for the pipe line:

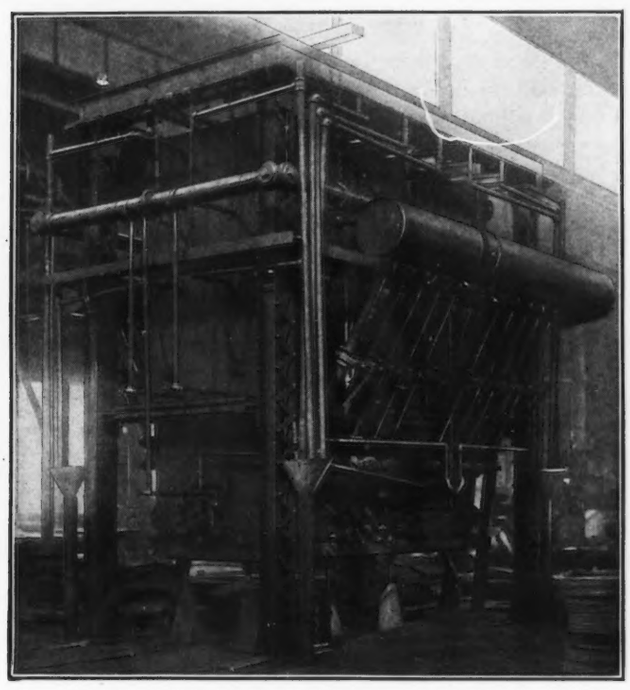
$$\frac{8\text{-}in.\ radius\ of\ pipe \times 160\text{-}lb.\ pressure}{16{,}000 \times 0.7\ efficiency} = 0.114$$

Therefore, No. 10 B.W.G. steel plate would be used for this pipe line. The waterwheel should be supplied complete with nozzle, gate, shaft, bearings and bolts for timber frame. The pipe should have double-riveted lap joints and at the intake end a cone to fit the flume and a long curve to connect with the waterwheel. The pipe should be shipped rolled, punched and nested, with necessary rivets (+ 10%) and riveting tools.

Specifications for 100-Ton Blast Furnace

Blast Furnace—All iron and steelwork for one rectangular steel water-jacketed blast furnace, measuring 36x84 in. at the tuyere line, for matte smelting, complete in details, as follows:

The curb shall consist of a heavy cast-iron bottom plate 1 in. thick, supported by six jackscrews and stands. Resting upon the curb plate will be the steel water jackets;



A 200-Ton Copper-Matting Furnace with Water-Jacketed Steel Spout

there shall be eight side jackets, each 21 in. wide, and four end jackets, so assembled that there shall be a smelting space of 36x84 in. at the tuyere level. The side jackets only shall be boshed, departing from the vertical 12 in. in 12 ft. The end jackets shall be provided at the bottom with a cut-out to accommodate a steel tapping jacket at the front and a cast-iron tapping block and spout at the back. (A copper water jacket or a water-cooled cast-copper block will be provided for the front end, when desired.) A water-jacketed steel-plate spout trapping the blast is usually furnished, but a trough-shaped spout, either cast iron or water jacketed, may be specified.

Each side jacket shall have two 4-in. diameter tuyeres, making 16 tuyeres in all; each tuyere to be provided with an independent tuyere box, air valve and connection to the bustle pipe. All jackets shall be of the best flange steel, the inside plate shall be ⅜ in. thick and the outside plate $\frac{5}{16}$ in. thick; all joints shall be welded. Jackets shall be provided with handholes, flanges for inlet and outlet water connections, binder lugs, hanger and spacer brackets. The water space for all jackets shall be 5 in. The binders for the jackets shall be of the trussed vertical type, two for each jacket, allowing the removal and replacing of any single jacket without disturbing the other jackets or their binders.

A complete set of water piping, valves and fittings shall be provided for supplying cooling water and for conducting discharge water to the pockets attached to the supporting columns of the furnace. The bustle pipe shall be 14 in. in diameter, extending on both sides the whole length of the furnace, and around one end where there shall be a 20-in. inlet to which is attached a 20-in. air gate with flange ready for connection to the 20-in. blast main; the blast main shall be made of No. 14 steel and shall have a 20-in. valve at its connection with the blower.

The mantel frame will be made up of three 8-in.x18-lb. I-beams at the sides and two at the ends. This mantel frame will be supported by four trussed-steel columns 17 ft. 7 in. high. The steel columns shall be provided with face- and cap-plates, connected to the column channels by heavy angles and gussets. The I-beams shall be connected at the corner of the mantel frame by steel angles and shall be provided with cast-iron spacers between the beams, which shall be bolted together.

The charging-floor plates shall be of cast iron, 1 in. thick, and shall extend for 2 ft. on each side of the furnace. On each side of the furnace there shall be dumping plates, 1 in. thick and reinforced by ribs; these shall extend inside the charge openings and down to the top of the jackets. Above the charging floor will be erected four cast-iron corner columns and two center columns with cast-iron lintels, forming four openings for charging. A sheet-steel hood and downtake with four sheet-steel charging doors, provided with chains, wire ropes, and sheaves, will complete the superstructure. The furnace shall be erected in the shops of the contractor, and all parts fitted into place and properly marked, so that the same may be easily assembled at destination. All drawings necessary for the erection of the furnace to be furnished by the contractor.

Forehearth—The forehearth shall be 12 ft. in diameter, made of heavy steel plate with angles top and bottom and cast-iron spout; the forehearth shall be lined with firebrick (silica, magnesite, or chrome brick when low-grade fiery mattes are to be made; a portable rectangular forehearth mounted on wheels might also be used; this may be arranged for either intermittent or continuous tapping of the matte).

Slag Cars—Two 25-cu.ft. round tilting-bowl slag cars shall be provided. The frame of the car shall be built up of steel and extended at one end to carry a platform. The axles shall run in brass journals and the wheels shall be provided with a brake. The bowl shall be readily removable from the trunnion rings and capable of being tipped by means of a screw and wormwheel at one end.

Matte Pans—A sectional matte pan, 4 ft. 6 in. wide by 20 ft. long by 3¼ in. deep shall be provided. This shall be shipped in 10 sections—two end and eight middle sections—with 1¼-in. bolts for connection. Each section shall have two pointed ribs cast in the bottom, 1½

in. high, and all corners shall be round, 3 in. radius. Molds shall be cast smooth with cored holes for bolts.

Furnace Tools—Six standard steel charging barrows with roller-bearing wheels; two 2-wheel coke-charging barrows with roller-bearing wheels; six No. 7 steel wheelbarrows; six coke forks; six No. 2 scoop shovels; six long-handled square-point shovels; six sledges with handles, two each 10, 12 and 14 lb.; 1000 lb. of assorted furnace bars; one 6-beam charging scale. For the dust chamber there shall be provided eight cast-iron 24x24-in. doors and frames. A brick or steel stack should be provided at the end of the dust chamber, the height and material depending upon local conditions.

The 200-Ton Smelting Plant

For the 200-ton plant, the desired tuyere area would be $\frac{200}{5} = 40$ sq.ft., which would be provided in a 42x140-in. furnace. The specifications for this furnace would be similar to those for the 100-ton furnace; a 14-ft. circular forehearth would be used, and three slag cars would be required. The air requirements per minute for the 200-ton furnace would be $260 \times 40 = 10{,}400$ cu.ft.; this volume would be supplied by a positive-pressure rotary blower, delivering 57 cu.ft. of air per revolution when operating at 185 r.p.m. under 2-lb. pressure. The horsepower required to run the blower would be $\frac{10{,}400}{1000} \times 10 + 10\% = 114$ hp., for which a 125-hp. electric motor would be provided; using the same electric-light plant as the 100-ton plant, a generator of 190 hp. will be needed, and 225 hp. must be delivered by the waterwheel. A 4-ft. single-nozzle Pelton waterwheel will develop 231 hp. with 368 cu.ft. of water per min. and 390-ft. head; a 20-in. No. 8 B.W.G. steel pipe would bring the water to the wheel. The furnace tools for the 200-ton plant would be the same as specified for the 100-ton furnace, but the quantities should be doubled.

Dredging in Philippine Islands

Dredging in the Philippines was active in 1914. The most successful company was the Gumaos, which averaged about 65,000 cu.yd. per month. The cleanups during the first half of the year were about 18,000 pesos per month, but later the cleanups increased to $30,000 and $35,000 per month. This company's dredge has operated almost uninterruptedly since its installation, about 23 months ago. It operates under rather severe conditions, on account of the clay and buried timbers contained in the gravel. While the company's dredge operated without interruption or breakdowns of any consequence, the corporate management developed friction which resulted in changes in the personnel of the board. Philippine Dredges, an Australian company, operated its dredges more or less continuously during 1914. In October, the yield for two dredges was 736 oz. of gold, and for the third, 39 oz., the last having been stopped for repairs to boiler. No. 4 dredge was started in October. The November cleanup was 701 oz.; two dredges were undergoing repairs. The Malaguit Dredging Co. operated in 1914, but was closed down for a period for repairs and changes to the boilers, screens and tables. Some important dredging interests sent drillers to the islands during the year, but the results of this exploration are not known. The gold output of the Philippines from lode and placer mining increased to $1,060,100 in 1914, an increase of about $300,000 over the production of previous year.

Copper in Germany

The following is a translation of a communication received recently by the New York office of Siemens & Halske A. G., Berlin, from Director R. Werner:

As you know, England has cut off the importation of copper by Germany and, besides, is putting pressure on the neutral countries by allowing the importation of copper by these countries only in case they pledge themselves not to reëxport it to Germany. Since the outbreak of the war England has seized every copper shipment, destined for Germany and the neutral countries of Europe, which she could get a hold of, detaining them at Gibraltar or in home ports. As a result, great economy of copper is being practiced in all branches of German industry, wherever possible, and copper is replaced by other metals, wherever that can be done.

There is enough copper in Germany to insure the manufacture of the necessary ammunition for a long time, certainly for a longer time than this war is going to last, so far as anybody can foresee. However, even the army is curtailing the use of copper. The principal consumption of copper for military purposes is brass, which is being manufactured into fuses for grenades and shrapnel. These two kinds of shells are already being manufactured with fuses made of other metals, particularly iron and steel.

A further demand for copper for military purposes is for buttons, cartridges, shellbands, facings for helmets, belt buckles, etc., which are now being manufactured of other metals, and experiments are going on all the time in this direction.

The industries engaged in the peaceful arts, naturally refusing to be brought to a standstill, have ever since been looking for ways out of this difficulty, and especially the electrical industry has already achieved the following:

(1) Standards have been established for insulated iron wire, which is already being manufactured in large quantities.

(2) Long-distance electric power transmissions are being conducted over steel cables.

(3) Cables are being manufactured of aluminum and steel instead of copper.

(4) Brass is being replaced in machinery construction to a great extent by steel and iron. Formerly, brass had been largely used in the German industry, because it can be worked better and easier, but not on account of the necessity of construction, as a great many parts can be just as well made out of iron. The same holds true for journal bearings.

(5) In the shipbuilding industry it had been a practice and tradition to make a good many parts out of massive bronze. This has been changed, and these parts are being replaced either by hollow castings of bronze or by iron or steel castings which are being coated or covered with bronze.

I could mention a good many other instances, but will restrict myself to those above to show that German industry is not at a loss for expedients, but is daily more successful in considerably reducing the consumption of copper and thus raising itself to independence from the

importation of foreign copper. In this connection I wish to point out that there is a constant effort being made to increase the output of copper from our domestic mines, for instance on the part of the Mansfeld mines. In a short time those mines will certainly be in a position to meet the demand, reduced by the above mentioned substitutes, on the part of the military authorities.

As a matter of course, under the present pressure of the circumstances, the different methods of replacing copper by iron, which are rendering Germany forever independent from the importation of copper or at least considerably more independent than she has so far been, are more and more perfected, and most of them, once in vogue, will also be retained in times of peace. Thus the goal will ultimately have been reached that the consumption of copper in Germany and also in other countries, which doubtless will also adopt the new working methods, will permanently decrease so considerably that in future times of peace it will represent only a small percentage of the former consumption. Then the United States, the greatest copper-producing country, will encounter great difficulties in disposing of her large production. The German demand for copper will certainly decrease to but a small percentage of what it has been before, so that the market for an important export article of the United States will be greatly restricted.

Toward this obvious injury of her commercial interests the United States is now drifting, unless she hurries to secure by political pressure upon England the unconditional right of exporting copper to Germany or at least to neutral countries, and, therefore, she has a deep interest in exercising this political pressure, in order to obtain from England a strict guaranty that no shipment of copper destined for Europe will be seized or detained, as has been done heretofore.

The following is a German view of the copper situation, expressed in a recent issue (Dec. 19, 1914) of the weekly report of the American Association of Commerce and Trade in Berlin:

It has been frequently said that the interruption of the copper import into Germany is a serious menace to her industries. Notwithstanding the fact that Germany produces only 2.4% of the world's copper production, which has a volume of one million tons per year, no conclusion should be formed upon the resources of copper for Germany. In the first instance, with the interruption of the import the exports also ceased, and, therefore, all the copper formerly used for exports in manufactured form is available. Furthermore, it is almost an impossibility to prevent the importation of copper entirely.

The following industries have the greatest interest in the pending copper question; manufacturers of ammunition, vessels of all sorts, apparatus for breweries and distilleries, plates for copper printing, manufacturers of bronze and brass ware, electrical industries, parts for the chemical industry, etc. A distinction should be made as to the uses of copper for these various industries, referring to refined copper of the best quality and ordinary copper as is utilized in many instances for various purposes.

In order to insure the supply for the army and navy, the authorities have taken the supervision into their hands in regard to the trade in refined copper. There are large quantities on hand of ordinary copper in the form of scrap copper, sufficient for the yearly demand of 8 lb. per capita, which is the same amount that is used, as per statistics, in times of peace. The German copper coins alone represent a weight of approximately 8000 tons; many copper products becoming unserviceable are being remelted and the copper used over again. It was these reserves that caused the failure of the copper corner in 1889.

Germany can be considered a vast copper mine from the fact that it has been imported in enormous quantities and retained in the country in many forms of manufactured goods.

According to official data, the import of copper into Germany in 1913 amounted to 220,892 tons and the German copper production to 40,278 tons in the same year[1]. The yearly copper import into Germany represents a quarter of the entire world's production and within the last 10 years nearly two million tons have been imported.

In view of these facts it is not surprising that Germany, after four months of war, is in a position not only to satisfy all demands of her army and navy, but largely those of her industries.

The German production of electrolytic and blister copper has multiplied in comparison with former years, and is steadily growing even during the present war. Existing plants for the production of refined and blister copper are being enlarged, as large quantities of scrap copper, filings, residues containing copper, are being delivered, attracted by good prices, material which in time of peace was largely sent to Belgium, England and France. On the other hand, copper is being replaced wherever possible by other suitable material, as for instance copper covered material is now used for many purposes, where formerly pure copper was used.

Another view is given by a correspondent of the London *Daily Chronicle* at Basel, Switzerland, who says:

Without suggesting that the war will resolve itself into an ammunition supply duel, in which the Allies would easily win, one can conclude that the German famine in war materials will play an important part in the destinies of Europe. If the Krupps are obliged to make use of kitchen utensils and old cartridge sockets after four months of war, what will happen if peace remains hidden for another two or three years?

A Zurich journal announces, the article says, that copper for bullet and shell manufacture is so scarce that the German soldiers get rewards in the following scale for objects found on the battlefield: 2s. 6d. for a kilogram of cartridge sockets, 1s. for a shell and 1½d. for each cartridge.

All the cartridges used for rifles and quick-firing guns have copper sockets. The tremendous quantity used in the last four months has caused the issuance of an order to German soldiers to guard against any excessive use of ammunition. Some of the means taken to secure supplies of copper in Germany are related in the article. In large towns patriotic merchants are offering to the army the copper fittings on shop fronts, plates, pillars and supports; three-quarters of the cartridges supplied to the police have been commandeered by the military; kitchen utensils have been requisitioned throughout Belgium and householders are being urged to give or sell to the army everything made of copper.

One of the military branches hardest hit by the scarcity of aluminum is that of manufacturing Zeppelins, for which huge sheets of the metal are required. The ban on the exportation of aluminum by Switzerland is said to have caused the abandonment of the Zeppelin factories at Schaffhausen and Friedrichshafen.

Tungsten Ores in 1914

The production of tungsten ores in the United States during 1914 is estimated as equivalent to about 990 short tons carrying 60% of WO_3, according to the U. S. Geological Survey. This output is the smallest since 1908, when only 671 tons was produced. In 1913 the production was 1537 tons, of which 953 tons was ferberite from

[1]The discrepancy in the statistics of copper production in Germany is due to the different bases of computation. The mines of Germany produce normally about 25,000 metric tons of copper per annum. The smelters of Germany produce a further quantity of copper that is derived from imported ore. Presumably ore supplies are now cut off just as that of refined copper is. The recovery of copper from scrap and junk is, of course, limited. A more important consideration is perhaps the extent to which other metals are being used in Germany as substitutes for copper. We have heard of steel wire being put up for long-distance telephone lines.—EDITOR.

the Boulder field in Colorado, a quantity almost equal to that of the whole country in 1914, but the production of the Boulder field in 1914 was only 466 tons.

Prices ranged from $6.50 to $9 a "unit."

Of the various tungsten minerals, the one produced in largest quantity was sheelite, from the Atolia district, in the Mohave Desert, Calif. A little sheelite was also mined in the Deep Creek Mountains, Utah. Small quantities of both wolframite and hübnerite were shipped from Arizona, and hübnerite was produced on Patterson Creek, in the Blue Wing district, Idaho. Some wolframite was produced near Penasco, N. M., and in the Clark Mountain district, near Ivanpah, Calif.

During the year 267 tons of tungsten ore were imported, against 401 tons in 1913. During 1913 there were 661 tons of tungsten metal and ferrotungsten imported. In 1914 these imports dropped to 192 tons.

Katanga Operating Three Furnaces

After the occupation of Brussels by the Germans, part of the executive staff of the Union Minière du Haut Katanga, including Secretary Velge, was transferred from Brussels to the office of the Tanganyika Concessions, Ltd., in London, where legally constituted board meetings are now regularly held. A circular recently issued by the Union Minière du Haut Katanga states:

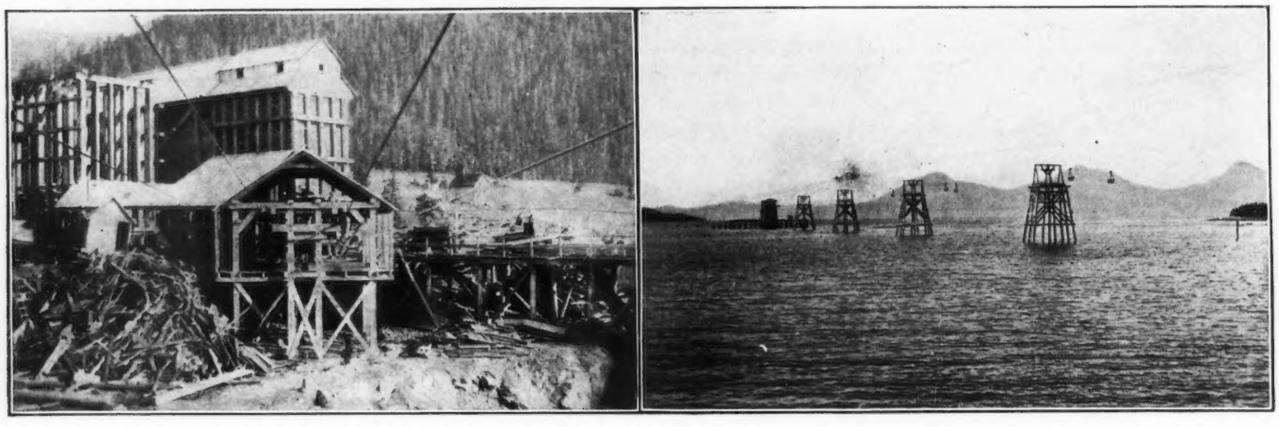
The company's smelting operations in Katanga have been kept running without interruption, although copper fell rapidly from £60 to £48 per ton, but has risen since to over £56 per ton. During the period that has elapsed since war broke out, although considerable difficulties have been caused directly by the war, two furnaces have been kept running, producing 3730 tons of copper up to the end of November. The third furnace was blown in at the beginning of December in order to increase the output of copper, and in view of the rising price of the metal, it is estimated that the total production for the year will therefore not be far short of the 12,000 tons anticipated in Mr. Williams' speech to the shareholders referred to above. The copper produced from the beginning of the year up to the commencement of the war was realized at a price which shows a profit of approximately £20 per ton over the cost delivered in England. In spite of the adverse conditions affecting the metal market since the beginning of the war, the copper produced and landed in England since then has been sold at a price which shows a profit of over £10 per ton over the cost delivered in London. The company is considering the immediate erection of two further blast furnaces which have already arrived at Beira.

The directors of Tanganyika Concessions, Ltd., have announced, according to the *Financial Times,* that the company is for the time being unable to pay the debenture interest coupon due on Jan. 1; arrangements had been made with the Société Générale de Belgique in Brussels to provide the amount required, but in consequence of the war and the occupation of Brussels by the German troops, the Société Générale is at present unable to remit any funds.

Aërial Ship-Loading System at Ellamar, Alaska

Owing to a long stretch of shallow water at its shipping point, the Ellamar Mining Co. found it necessary to arrange some rapid and economical method for loading its copper ore on ships. The ore is high-grade, and is shipped to the smeltery at Tacoma, Wash.

After a study of the problem it was decided to install an aërial ropeway leading out to a loading dock at which the steamers could tie up and load easily. The tramway is of the friction-grip type, and connects the shaft with the loading dock, 2200 ft. out in the bay. It has a capacity of 200 tons an hour, the idea being to delay the ships as little as possible for loading. The buckets have a capacity of 2000 tons of ore.



SHORE STATION AND SEAWARD VIEW OF THE ELLAMAR LOADING SYSTEM

There are six towers of wood, five of them in shallow water, and properly protected against attacks of teredo. The track cables are 1 in. and 1⅝ in. in diameter, and of the lock-coil type. The pulling rope is ⅝-in. special steel. Six steel chutes are being installed in the loading bins, these having undercut, air-operated gates. The tramway was supplied by the Broderick & Bascom Rope Co., of St. Louis. The accompanying photographs show part of the installation.

Radium-Uranium Ratio in Carnotites

S. C. Lind and C. F. Whittemore in *Journ. Amer. Chem. Soc.,* 1914, XXXVI, 2066-2082, report that samples of carnotite representing large quantities (a few hundred pounds to several tons) of ore showed a Ra : U ratio identical with that of pitchblende, 3.33×10^{-7}, whereas those from a few pounds of ore tended to exhibit abnormal (high or low) ratios. This is explained by supposing that "transposition" of radium has occurred within the ore bed, producing local differences which are equalized in mixing large quantities of ore.

Pato Property of Oroville Dredging Company

SYNOPSIS—This South American dredging property has rejuvenated Oroville and with an adjacent area, also controlled by the Oroville company, is estimated to contain over $12,000,000 in gold. W. A. Prichard recently completed an extended investigation of these properties situated in the Nechí River valley, Colombia. He estimates a profit on present showings of over $5,000,000 for Pato, and of over $4,000,000 for the Nechí property across the river. Pato's drilled area is estimated to contain 22,419,490 cu.yd., having an average recovery value of 31.6c., and Nechí is estimated to have 6,855,900 cu.yd., averaging 71.86c. per cu.yd. Dredging costs on Pato have been reduced to about 11c. per cu.yd., and when a second dredge is added and the Nechí dredge also operated from the Pato power plant, operating costs are expected to be 7½c. per cu.yd. for Pato, and 8c for Nechí. Mr. Prichard's interesting report on the Pato property is reproduced herewith nearly in full.

As a result of 12 months' examination of the Pato property, during which time 291 Empire hand-drill prospect holes and six shafts were sunk with the object of extending and checking the prospected areas, the prospected area undredged at Oct. 1, 1914, is estimated at 528¾ acres of an average depth of 26.3 ft., and of an average recovery value of 31.6c. per cu.yd. This area is calculated to contain 22,419,490 cu.yd. of a gross value of $7,092,100. The field operating cost of dredging, on the basis of one dredge on Pato and one on Nechí, after 12 months from Oct. 1, 1914, and two on Pato after 18 months from that date, is $1,744,462; estimated net returns, $5,347,638, or £1,100,000, approximately.

Prospect of Additional Areas

Outside of the prospected areas small extensions can be expected beyond the outlined boundaries. Between the estimated area and the Nechí River there is a fair amount of low river bottom that will probably prove payable as indicated by isolated holes of payable value and by the results of the dredge which, although not reaching bedrock, returned from 15c. to 33c. per cu.yd. for a considerable stretch in its hurried progress from the point of its construction to the tested area. There are a few acres of this ground along the river too deep for the Pato dredge, for which the Nechí dredge could be utilized after exhaustion of the Nechí ground. The future dredging prospects of Pato, therefore, outside of the tested areas, while indefinite, are by no means negligible. Aside from these exceptions, no important asset has been discovered.

Gold-bearing gravel benches have at one time covered several square miles of the Pato property, but these are now much cut up and depleted by ancient workings. Only detached areas of the poorest gravel have been left. By drilling scattered prospect holes over these areas it appears that they are too small or not of sufficient value to be profitably worked on a large scale. Some of them can probably be worked at a profit on a small scale, perhaps, best by systematic tributing or leasing.

California Hill with an area of 13¾ acres and an average depth of 45½ ft. is the largest and richest of these deposits. Eight drill holes and two shafts sunk on this area give it a total of 1,008,200 cu.yd., with an average value of 19.7c. per cu.yd., making a gross value of $198,970. To work this deposit, it would be necessary to pump the water from the Nechí River, necessitating a mile of pipe line, electric driven pumps and hydraulicking equipment.

I understand that on a hydraulic property being operated higher up the river, it requires 17c. ground to pay operating expenses, although that property has a water supply under gravity head. It is obvious on this basis that the margin of profit, if any, to be obtained from California Hill is small.

However, as there appears to be a small hydraulicking deposit on the Nechí property across the river, the Pato management may later on have an opportunity to obtain figures from local operations that would justify the equipment of California Hill and the working of it as a small side issue. At present California Hill is used for camp purposes and is occupied by about $25,000 worth of buildings.

Present High Yields

The average yield of the material handled from the time the dredge reached the prospected area up to the present has been more than double the estimated average value of the dredging area.

In the drilling of this ground the drill holes were not sufficiently close together to indicate more than that the gravel was payable. In this part of the property there was only about one drill hole to each 10 acres. The richest gravel formed a strip of only about 500 ft. in width and was only penetrated by two or three holes.

That the dredge struck the richest ground first was due to the accidental lay of the land. There was no other approach to the prospected area from the river when the boat was erected. The dredge has been kept in this best portion for systematic working as well as for sound financial reasons. Higher than average yields are expected to continue until in the spring of 1915, when lower average yields may be expected.

The yardage that has been dredged since Oct. 1, 1914, and what will be dredged in the coming months, of this high value is such a small part of the total prospected area that the general average of the remainder will not be greatly reduced as might be feared. Wide variations in the yield may always be expected and no individual prospect hole must be taken as the average of any particular piece of gravel. It is only in the aggregate that drilling may approximate the average of an area.

Dredge-Operating Costs

The yardage capacity of the Pato dredge varies with the amount of clay in the material handled and the depth and character of the gravel. During the months of July and August, 1914, the material handled was 128,488 and 139,-

547 cu.yd., respectively. The dredge was working under fairly normal conditions. These were the first months of operation with the dredge-pond water in a condition of positive control by means of a dam across Pato Creek, completed in July, 1914. Prior to this time the dredge depended upon the elements, resulting in muddy pond water during the rainy periods and a total stoppage in the dry periods. The muddy water caused enormous wear on pumps, etc., with heavy losses of running time and heavy cost for renewals and repairs.

The high average operating cost of 17.71c. per cu.yd. for the 11 months, from Oct. 1, 1913, to Aug. 31, 1914, was due chiefly to this cause. For July and August the cost per cubic yard was 10.25 and 11.52c., respectively, including some extraordinary expenses.

In addition to the diverting dam across Pato Creek for supplying pond water to the low ground, a pumping plant is being installed to aid in dredging the higher ground. With proper engineering care there should never again be serious trouble or stoppage on account of muddy pond water.

It appears from recent operations that the average dredge capacity is over 125,000 cu.yd. per month, but to be conservative I have estimated the operating cost on the basis of an average monthly yardage of 100,000 cu.yd. With one dredge bearing all of the overhead expense of management, power, etc., the field operating costs should never exceed 11c. per cu.yd., exclusive of bullion realization. After the Nechí dredge begins operating, bearing its proportion of the overhead expenses, the costs for Pato should not exceed 8c. per yd., exclusive of bullion expense. With two dredges on Pato, and one on Nechí the cost for Pato should be about 7½c. per yd., inclusive of bullion realization, which amounts to about 0.7c. per yd. on a yield of 32c., or 1.5c. on a yield of 70c. per cubic yard.

In computing the net returns, the cost inclusive of bullion expenses, is taken at 12c. up to the period when the Nechí dredge should be running; 9c. thenceforward to the probable beginning of operations of a second dredge on Pato, which I am assuming will be ordered, and 7½c. per cu.yd. during the remaining life of the property. I believe these figures are conservative, and give some leeway for accidents, changes of management, etc., incidental to operating in the tropics. This estimated cost is built up in the following manner: Running expense, $3600 per month; current repairs, $3600; clearing 4.8 acres at $250, $1200; water supply and pond expenses, $1500; electric power, $800; general expense, $2900; bullion expense at 0.7c. per yd., $1400. Two dredges would therefore dig 200,000 cu.yd. for a cost of $15,000 per month, or 7½c. per cubic yard.

Another Dredge Recommended

It would require 20 years, more or less, for the present dredge to exhaust the estimated area of dredging ground on the Pato property. It is not likely that the dredge will last that long, even without taking into account the probable additional ground. Aside from this, I believe that a direct saving of 1½c. per yd. to Pato and 1c. per yd. to Nechí could be made by distributing the fixed expenses over three dredges instead of two. This would mean on 20,000,000 yd. $300,000 to Pato, and on 6,500,000 yd., $65,000 to Nechí.

If we compute the interest at 5%, say on $2,000,000 profit, which with one dredge would probably be the minimum remaining in the Pato property at the end of 10 years, and if we reduce the principal 10% each year, we shall have $500,000 in interest. It appears from these figures that a new dredge that would cost erected not over $250,000 would bring an added return of about $850,000 to the Pato and Nechí companies.

An advantage can be gained by adding a dredge at this particular time in that the construction could follow upon the heels of the Nechí dredge. This would make a considerable saving in being able to continue the employment of the skilled mechanics now on the ground who were taken down at considerable expense and in the use of the building arrangements, etc., prepared at considerable expense for the erection of the Nechí dredge. I therefore recommend you to add another dredge to the Pato property as soon as possible. The new dredge should be of the same capacity as the present Pato dredge with interchangeable parts, as much as possible, to avoid carrying two different sets of spares.

Particulars of Prospecting

Where gravel deposits extend several feet below the permanent water level, as those of the dredging areas of Pato, there is no method commercially available for accurately determining their gold contents. Drilling, which under these circumstances is the most accurate, gives only approximate results that are subject to wide variations owing to the personal variation of method, carelessness in drilling and panning, varying physical properties of the deposit, and to the economic impracticability of drilling holes sufficiently close together.

Having driven a tube and pumped the gravel out of it foot by foot to bedrock and panned the gravel so extracted and weighed its gold contents, we desire to know just what proportion of the displaced gravel and gold entered the tube and subsequently the pump, and what proportion was pushed aside by the tube in entering the ground and how much was pushed out of the tube in pumping. This proportion varies in different sections of the hole and also in the different holes, more especially where the physical character of the deposit is different. Many other variable quantities common to all types of drills enter into the process, but suffice it to say that we can only assume an average factor or proportion which is reliable to within perhaps 50% of the true average figure on any individual drillhole.

Drilling Factor

In the early drilling of the Pato property a theoretical factor arrived at in an entirely different field was necessarily used. For this examination, we had the advantage of a dredge in operation and under our own direction dredged over an area where we had previously drilled 17 holes. Carefully calculating the area and cubic yards represented by each hole and knowing the actual yardage and gold yield by the dredge, we determined mathematically the factor for the drill holes which would give the actual value recovered by the dredge. This factor works out at 387 ft. of hole for 1 cu.yd. of gravel removed.

This factor or proportion was then used for all of the holes drilled under my supervision on the Pato property. I further checked six of my drill holes by sinking shafts alongside. In this checking I compared the dry weight of the gravel from both the shaft and drill holes and determined the drill factor for each case on that basis. In

those shafts where there were no water difficulties, the factor obtained in this way checked up closely with the factor obtained by dredging. In consequence, the drill results that have been obtained on the Pato ground during this examination are figured more scientifically than is usually possible or considered necessary.

In calculating the present dredging area of Pato, I have used the results of 89 holes drilled under my supervision, 38 drilled under C. H. Munro, six drilled by A. P. Rogers and one drilled by E. B. Kimball.

In estimating the yardage, a circle of uniform size was drawn on the map about each hole, and the area included in the polygon formed by joining the points of intersection of the circles was taken as the area corresponding to that hole. That area and the depth and value of that hole were used for determining the cubic yardage and gross corresponding to the hole. These figures thus obtained separately for each hole were then summed up to obtain the total area, yardage and value. In this manner, errors of calculating results are not introduced by varying distances between drill holes of widely different values and depths.

Fineness of Gold

By assay of the gold recovered from the drillholes we found that the bullion fineness varied from 848 to 937. The gold of greatest fineness is the thin, flaky gold from California Hill, while the gold of lowest fineness is from certain parts of the low ground in the dredging area where the grains are coarser. I have used an average fineness for Pato of 871 or $18 per oz., which corresponds to the usual fineness of the bullion recovered by the dredge and is about the average of several assays of drill samples. Mr. Munro used a fineness of 897 in his calculations, and Mr. Rogers used 850. These figures are all within the range of accuracy in drilling, and within the range of bullion variation, as determined by dredging and by assay.

Former Reports

Previous to the purchase of the Pato property several years ago A. P. Rogers drilled with a Cyclone steam drill 16 holes and sunk four shafts and made a report for the vendors. Later, C. H. Munro drilled 45 holes with a Keystone steam drill and 37 holes with the Cyclone drill. Afterwards E. B. Kimball drilled two holes checking Mr. Roger's holes and two holes to check Mr. Munro's holes.

With an Empire drill, I checked fairly closely, but with slightly higher results, two of the Munro Keystone holes, one of which was also a Kimball check hole. The Empire drill, however, gave much higher results in four holes drilled to check four of the Cyclone drill holes. I believe, therefore, that in using the Cyclone holes in my estimate as reported by Munro I have introduced an added factor of conservatism. Considering the circumstances under which they were made and in the light of recent and more exhaustive examination, I consider that the early prospecting reports on the property are very creditable. The errors in estimating the ground were made on the safe side and their prophecies as to future extensions of the dredgeable areas have been borne out by further examination.

The most serious criticism that has been aimed at the early reports is with reference to the free washing of the ground. With regard to this point, the dredge difficulties that have been attributed to clay were mostly due to the lack of provision for sufficient pond water. There are some clay difficulties, but they are not so serious as has been thought. By light digging in the clay beds, frequently encountered, the present dredge crew is successfully getting through the bad places without clogging the buckets. It is, however, always necessary to have a negro at the hopper with a bar to assist the material out of the buckets.

Geology and Character of Ground

The Pato and Nechí properties lie in an oval basin surrounded by crystalline rocks. This basin has been cut through by the Nechí River, which separates the two properties. Within this basin are flat tables of gravel deposits whose edges form terraces. The bedrock of each of these gravel benches is clay, either red or blue, according to exposure, in which are included beds of peat or brown coal. Each of these gravel benches is a reconcentration of the bench above it and represents a former stationary level of the river.

California Hill is a remnant of the upper bench. Below this was a lower bench the bedrock of which stood above water level. These two benches have been nearly removed by erosion and ancient workings. The third bench partly submerged forms the greater portion of the higher dredging ground. The fourth bench is that being dredged now and is nearly submerged. The fifth bench, wholly submerged and covered with recent river sand, is the dredging area of the Nechí and some of the Pato not thoroughly prospected. Below this on the Nechí River bank we know from Mr. Rogers' drill hole No. 1 that there is still a sixth layer of gold-bearing gravel between the depths of 66 and 74 ft. We know nothing yet about what lies below this.

The outer and higher bench gravel lies on the clay which lies directly upon the rim rock; but toward the center of the basin, where we encounter the lower layers of gravel, we know nothing about what lies under the clay which we assume for dredging purposes to be bedrock. In this connection I would recommend that the management dig into the bedrock from time to time with the dredge on the chance that the supposed bedrock may be in places only an intermediate thin seam of clay.

Since each successive gravel bench as we go downward is richer, it is possible that deep drilling may disclose ground rich enough for successful drift mining. I do not, however, attach much importance to this possibility.

The gold of the Pato property has originally been brought in from the surrounding hills, all of which are auriferous, by the small storm streams. By the successive concentration described above, we now have the deposits of economic value.

In each concentration, part of the finer grained gold has been floated away so that the average grain of the lower deposits is fairly coarse, although nuggets or rounded grains are seldom dug up. The gold is of fairly uniform-sized thin flakes. It is easily saved by amalgamation. There is but little black sand, of which the most valuable portion is caught by the dredge and saved for further treatment.

Equipment

The Pato property is equipped with its own hydroelectric power plant, one 8½-cu.ft. dredge, an ice plant, and a complete repair shop.

The power plant consists of a dam built of 17,000 cu.yd. of concrete which supplies water under a head of 87 ft. to three 600-hp. Pelton-Francis turbines which drive three separate electrical generators of 300 kw. each.

I have made a graphical chart of the daily records of power used and of the power unused over the period from Oct. 1, 1913, to Oct. 1, 1914, which is the driest 12 months in the last six years of which a rainfall record has been kept. These calculations indicate that without allowing for reservoir storage, there was always sufficient power to operate one dredge; that for 36 days out of the year the power would have fallen short of supplying two dredges, and for 86 days it would have fallen short of supplying three dredges. Such shortages would, no doubt, have been wholly or nearly made up by reservoir storage repleted by the occasional rains, so that one may count on at least two dredges and possibly three running continuously during average years. With three dredges in operation, it may be necessary to close each one in turn from two weeks to a month. Such a stoppage, moreover, would be advantageous for general repairs.

The Pato dredge is an all-steel, close-connected, 8½-cu.ft. bucket dredge. Aside from an obvious mistake in design of the hull, which has caused it to sink twice, the dredge has proved satisfactory. The mistake in the hull is being remedied by the addition of pontoons.

Repair Shops

Provision has been made on the property for repairing the largest parts of the dredge. The large tools in the machine shop are:

1 20-in., 16-ft. lathe.
1 3-in. radial drill.
1 16-in. shaper.
1 600-lb. steam hammer.
1 250-ton hydraulic press.
1 50x25-in. 2-chuck, 16-ft. lathe.
1 36-in. punch and shears.
1 36-in., 10-ft. heavy planer.
1 Acetylene welding-and-cutting outfit.

The woodworking shops contain:

1 50-in. portable sawmill.
1 54-in. sawmill.
1 ⅞-in. band saw.
1 20-in. double-surface planer.

The property is well equipped with construction tools such as derricks, rockbreaker, cement mixers, air compressors, winches, etc. There is also a large gasoline launch, tram lines, warehouses, bullion laboratory, etc.

The skilled dredge laborers are mostly drawn from the dredging fields of America, and come out under contract of one or two years, while the mechanics and clerical staff are of several nationalities including a number of Colombians. The common laborers are mostly natives from the lowlands of Colombia and negroes from the British Islands off the coast. These laborers are very inefficient and independent, and considerable skill is required in handling them. They are worked on contract as far as possible.

Climatic and Living Conditions

The days are disagreeably hot and steamy, the temperature ranging between 70 and 90° F. It rarely rains in the daytime. The nights and early mornings are cool and pleasant, except for parasitic and insect pests of many descriptions. During nine months of the year it rains nearly every night and at times as much as 9½ in. in a few hours.

The camps for the white men are made comfortable by means of mosquito-proof houses, electric fans and ice water. Owing to the necessity for careful and sanitary living, the percentage of sickness among the white employees is lower than in some of the ideal climates of the world. Typhoid and dysentery, so deadly in Colombian towns, are unknown at Pato.

The company has a resident physician who looks after the health of employees and the sanitation of the camp. Good living quarters and food are provided for the white employees. The natives suffer a great deal from malaria, blackwater fever and skin diseases, owing to their insanitary mode of living, poor food and excessive use of rum.

Governmental Relations

The Colombian government, both state and national, is making a laudable effort to promote and foster the development of its natural resources by foreign capital. However, a peculiarity in its laws gives almost sovereign power to the municipalities in the matter of local administration and taxation. Much of the good intent of the government is thereby undone through the tendency of the municipality to fatten on the industry that is unfortunate enough to become established within its jurisdiction. The Pato property is continually persecuted by the municipality of Zaragoza by the levy of exorbitant duties both legal and illegal so that it is necessary to keep a salaried native lawyer on the property, another at Remedios, the head of the district, and another at Medellin, the state capital.

*

Ninth Perkin Medal Presentation

On Jan. 22, Dr. Edward Weston, of Newark, N. J., was presented with the ninth impression of the Perkin medal, given for distinguished service in chemistry and electrochemistry. The ceremony took place at the Chemists' Club, Dr. G. W. Thompson presiding. In his introductory speech he stated that progress in electrochemistry is dependent on the ability to measure current, and in general, "efficiency" means efficiency in the use of power, which can only be obtained by convenient methods of measurement. These Doctor Weston had made possible. However, his claim on them was more direct, being based on his chemical work itself, as would be shown later.

Doctor Chandler, as senior past-president of the Society of Chemical Industry, then spoke, giving a brief biography of Doctor Weston, of whom his parents had vainly attempted to make either a dentist or a physician, but who, following his own inclinations, came to America at the age of 20 to practice as a chemist.

In his first weeks here, Doctor Weston visited him, Doctor Chandler, in search of a position, but he was unable to do more than to give letters of introduction, one of which got Weston work manufacturing photographic chemicals, chiefly pyroxylin. While in this position he saw an advertisement for a man having some knowledge of chemistry and electricity, particularly electroplating. He applied for and was offered this position, his new employer wishing him to come immediately. He was unwilling to leave his then employer in the lurch, so offered temporarily to work making photographic chemicals by day and electroplating by night. [This habit of a 20-hr. working day he still continues.—Editor.]

The plating establishment was soon straightened out. To eliminate plating by electricity from batteries, Weston developed the plater's dynamo, went into dynamo building generally, electric lighting and at length into the building of electrical measuring instruments. Having

briefly reviewed his career, Doctor Chandler then presented the medal.

Doctor Weston spoke briefly in reply, thanking Doctor Chandler and the Society, and saying that although he had apparently wandered far from chemical realms, yet he felt that his work had been rendered possible by the application to all subjects of the analytical reasoning and the breadth of view engendered by chemical training, and that he felt he had always been a chemist at heart. He also again thanked Doctor Chandler for his letter of introduction of 45 years before. L. H. Baekland followed him, giving some of the features of the chemical work in the old wet-plate days, discussing the chemistry of electroplating, the development of resistance alloys of no or minus temperature coefficient, the flaming arc, the hydrocarbon filament-flashing process, the structureless carbon filament, the Weston standard cell and others of Doctor Weston's inventions.

Doctor Weston then spoke again, giving at greater length the details of the inventions, and of some of the steps leading to them. The hydrocarbon filament-flashing process was developed in the early days of the electric light. No mechanical process could manufacture a filament approximately 6 in. long, weighing about 7200 to the ounce, of uniform resistance. The weak spots broke first. On heating these in an atmosphere of hydrocarbon vapor, the vapor was decomposed and carbon deposited. The weak spots, which were hottest, got the most carbon until uniform resistance was obtained.

In attempting to obtain a uniform pyroxylin film to make the structureless carbon filament, a still further advance, the solvents were ether and alcohol, and when these were allowed to evaporate in air the film always "checked" and pitted. This was finally avoided by lowering the speed of evaporation by keeping the plates in an atmosphere of air mixed with the fumes of the solvent which were made to escape very slowly. From these nitrocellulose films the nitro-group was eliminated by ammonium sulph-hydrate, the film cut to filaments, which were then heated to form the carbon filaments. These filaments were almost uniform in their own length when produced, but were subjected to the flashing process, partly to equalize small differences between different filaments, partly to produce a graphite coating on the carbon. But space forbids describing at length the many chemical and physical-chemical problems here encountered.

He also spoke of the importance of examining even fundamental definitions. Thus in our boyhood textbooks one of the properties by which metals and mixtures of metals could be told was by the rise in their electric resistance upon heating. Nevertheless he had developed alloys which had no temperature coefficient, and others which had a minus coefficient, i.e., the resistance fell with increase of temperature.

Another case was even more amusing, for several years after he had actually begun running his first dynamos, lighting a number of arc lights in series, several distinguished physicists proved that it was *impossible* of accomplishment. One of them gave an absolute mathematical demonstration of this. But as Doctor Weston remarked, "What are textbook theories when confronted with facts?"

The chemistry of the flaming-arc lamp, the cored electrode for arc lights, the Weston cell, and of electroplating and electrolytic refining were also touched on. In the last he had also had to work against an established belief, as it was held a kilowatt-hour could only deposit so much metal, regardless of electrode spacing, composition of electrolyte, or any other factors. Yet the efficiency of electrodeposition had been enormously improved in spite of the theorists. In short, it could be easily seen that one of earlier speakers was well within bounds in saying that the medal was equally deserved for services to chemistry, to electricity, or to electrochemistry.

A. L. Queneau

The war looks nearer to us Americans when we know that some of our own folks are at the front. Mr. Queneau lived so long with us that we claim him as one of us, though he never relinquished his French citizenship. After completing his courses at home he studied at Columbia and then became connected with the New Jersey Zinc Co., by which he was employed several years. He went to Broken Hill for the Zinc Corporation, and returning to the United States, became manager of the Bartlesville Zinc Co., in Oklahoma. Resigning from that position he resided for several years in Philadelphia, became interested in electric zinc smelting and went to Belgium to develop his process. There he was when the war broke out and he had to drop everything to rejoin his regiment.

A. L. Queneau

Up to November he was with the heavy artillery at Soissons. Then he was detailed to act as interpreter with the British forces, a useful employment of him inasmuch as he speaks English better than most of us, besides which he is a brilliant engineer. The accompanying photograph was taken of him at the British base at Havre at about Christmas. He wrote that he was about to leave for the front again.

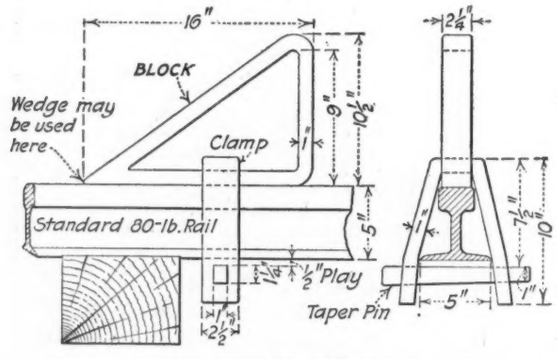
Details of Practical Mining

Steam-Shovel Block

By L. B. Pringle*

The block-and-clamp device herein described was developed and adopted for its steam shovels by the Oliver Iron Mining Co. ,Hibbing, Minn. It is of simple construction, is quickly and cheaply made, is easy to handle, and has proved a success. The block is placed against the hind wheel of the shovel and prevents any backward movement of the machine as the dipper gouges into the dirt, or when the shovel is working on an up-grade.

The material for block, clamp and pin is wrought iron. The block is made from 1x2¼-in. stock bent into a right-angled triangle with dimensions as shown. The clamp is of 1x2½-in. stock, made to fit snug over the rail and through the block. The holes in the sides of the clamp are cut to fit a pin 1x1¼-in. tapered to 1x1 in. and 10 in. long. The distance from the top of the clamp to the upper edge of the holes is 7½ in., thus allowing ½-in. play beneath the bottom of the rail.



Assembled Parts of Steam Shovel Block

There is approximately 10 in. of longitudinal play between the clamp and the inner edges of the block. This permits the clamp to be placed against a tie, and the block so adjusted as to have its working face over the tie or beyond it.

If the block is inclined to slip, a small iron or wooden wedge inserted between the block and rail at the rear end will make it secure. Unless the shovel is unusually large or is working in extremely hard ground or is on a maximum up-grade, one block and clamp will be sufficient.

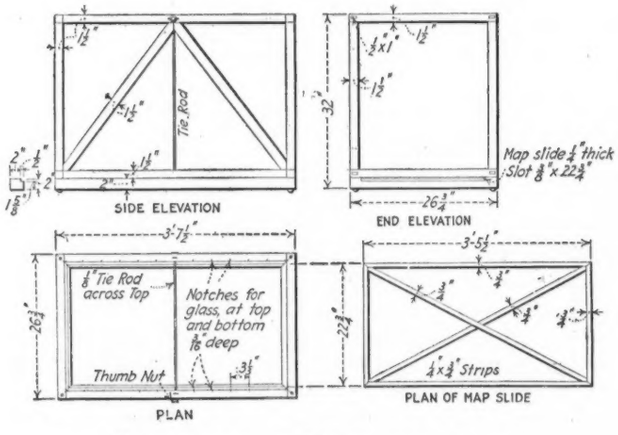
First-Aid Jar

A new first-aid package has been brought out by the National Affiliated Safety Organizations. It is a glass jar protected on the outside by a wire cage and made tight by clipping the glass cover down against a rubber gasket. The jar is 9½ in. in diameter and 6 in. high. The handle is molded in the cover. The first-aid materials are arranged in the jar so as to be quickly accessible and always visible. The chief advantages claimed for the jar are its convenience and its cleanliness. Undoubtedly for most industries the device is highly serviceable. It is questionable whether it is available for underground use, inasmuch as it is about impossible to keep glass from breaking underground and the protection used in this instance is quite inadequate, although the protection together with the fact that the glass is annealed, probably renders the jar safe against breaking on the surface. It would appear that the same design worked out in enameled ware of some sort would make an excellent container for an underground first-aid outfit. It might be, however, that this would prove too expensive. The jar is described in *N. F. A. Safety Bulletin,* of Nov. 1, 1913.

*Formerly engineer with Oliver Iron Mining Co., Hibbing, Minn.

Mine Model of Vertical Glass Plates

A mine model to be of the greatest value must be simple in construction, so that it can be easily taken apart to make additions, easily movable, and so designed that the greatest possible amount of information can be placed upon it, both in plan and section, and this information



Framework of Model and Slide

seen as a whole without removing any portion of the model. Such a model is here described.

The illustration shows the frame. The bottom pieces are 2x2½-in. and the others are 1½x1½-in. wood strips. The upper pieces are mortised together and secured by screws, as shown, also braced by 1½x1½-in. pieces and held by tie-rods. Vertical slots, cut on the inside of the upper and lower horizontal 1½-in. side pieces hold panes of glass, upon which sections of the mine workings are drawn. The upper side of one bottom end piece is cut out to permit the passage of the map slide, and the other bottom pieces are grooved, as shown in section, to support the slide. This map slide is made of ¾x¼-in. wood strips, light to handle but strong enough to permit tacking the mine map upon it. A handle aids in drawing the slide out. Casters on the bottom of the frame facil-

itate the moving of the model about; with all its glass sections in place, two men can easily lift it. The slots to hold the glass are shallow, in order that as little area of glass and map may be wasted as possible, and since the frame will naturally spring a little with the weight of glass and from weathering, the tie-rod at the top is threaded at one end and a thumbnut placed on it to take up any slack between glass and frame.

The model itself consists of a series of parallel, vertical glass plates, upon which the various mine workings, geological features, etc., are drawn. These plates should be of the best grade of window glass. If the regularly spaced vertical sections do not include all the workings, such as important raises, etc., these may be projected to the nearest section, always projecting in one direction to avoid confusion; the projections may be drawn in dotted or broken lines to distinguish them. In special cases, as for a working shaft, it may be desirable to add an extra section even if irregularly spaced. The mine workings, rocks, ore (broken or in place), faults, dikes, surface, etc., can be shown by lines, conventional designs and colors. Sections are first made on detail paper, the glass plates laid over these and the work traced. In this way the work is easily kept uptodate, and, if a slide is accidentally broken, a new one is easily traced. The marking on the glass may be done with colored picture varnish and linseed oil, oil colors, water colors, or, if the glass is first cleaned with alcohol, lines may be ruled with pen and drawing ink. If a crow-quill pen is used for the ruling, the ink is less liable to run. Black waterproof drawing ink for the outlines of mine workings and water colors and conventional designs in ink for geological features make an effective combination; they are also easily applied and removed. The mine map on tracing cloth fastened to the slide with thumb-tacks is as easily removed and corrected as one of the sections.

The dimensions given in the illustration are for a model made to the scale of 1 in. equals 30 ft., and will include a block of ground 1200 ft. long, 700 ft. wide and 900 ft. deep vertically. These dimensions may be varied to suit different conditions and scales; intermediate sections are easily added. When not in use, the model should be covered by a black-cloth hood to keep it clean and protect it from flies.

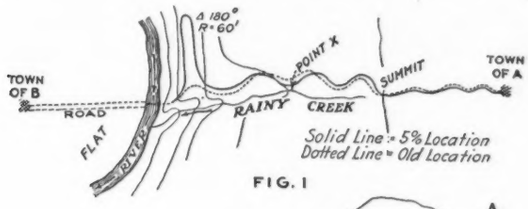


FIG. 1

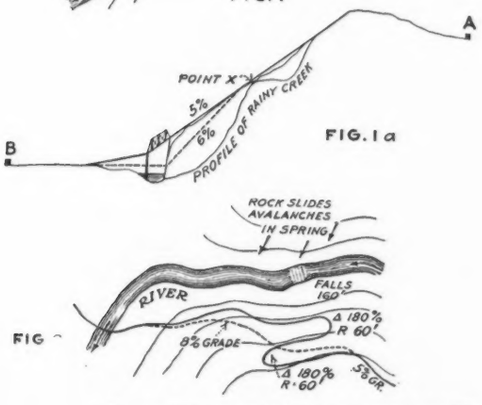


FIG. 1a

FIG

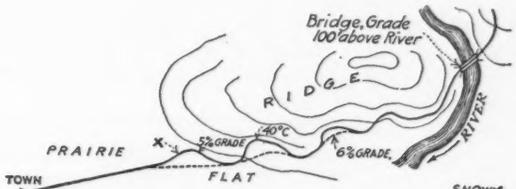


FIG. 2

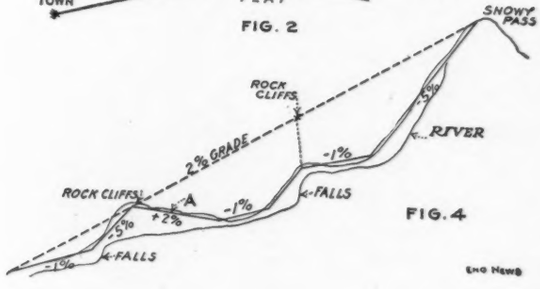


FIG. 4

ENG NEWS

EXAMPLES OF UNECONOMICAL HIGHWAY LOCATION IN MOUNTAIN COUNTRY

"Dont's" in Mountain Road Location

In *Engineering News*, F. W. Harris, recently locating engineer for the Washington state highway commission, gives some illustrations of mistakes made in locating highways in mountain country. He argues against the attempt to maintain a uniform 5% grade.

In Fig. 1 the old road, dotted, is on a varying grade of 6% and 7%. The new road is located on a 5% grade. The loop shown was necessary to develop down to the bridge site, for the other side of the river was flat. Poor alignment was not the worst feature, however, for at the point x the road was almost in the creek, and at the bottom of a narrow ravine, where in November conditions bade fair to rival the Grand Canal. Had a 5% grade been used at the point x, and a thousand feet of slack grade used there, thence descending on a maximum 6% grade, the loop would have been eliminated and the quantities on the trestle approach to the bridge across the flat would have been cut in half.

In Fig. 2 the elevation at the bridge site was fixed and the ridge across was followed down to the flat. The heavy curvature was used to develop distance as the support ended at x. Here one-half mile of 6% grade on the ridge would have eliminated 180° of central angle and two 40° curves.

Fig. 3 shows a double-loop development on a steep mountain side to maintain a 5% grade. The development is roughly three miles in length. Two miles of 8% would have cut out the loops. One fall of 160 ft. in the river shows how steep the descent is. To cut out the loops a line was run on the other side of the river, but this was only jumping from the frying pan into the fire, for that side was bare and rock slides and avalanches came down in the months of March and April.

Fig. 4 shows an approach to a typical mountain pass.

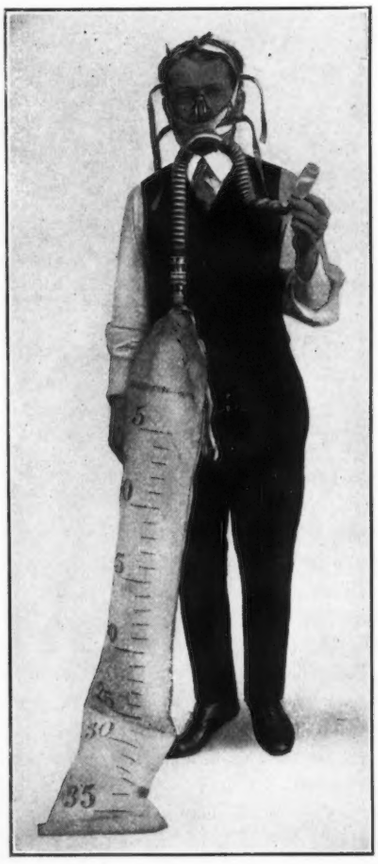
By breaking grade and following the benches, the cheapest and straightest line is secured. Frequently these benches ascend in elevation and an adverse grade at point *A* is used. It is better to use an adverse grade than to continue on a straight descending grade and develop around those points. Adverse grades should be frequently used to secure a tangent on the ground. It will be found rarely necessary to exceed rising 20 ft. above the original surface under such conditions. Grade should be broken every 300 or 400 ft. if necessary.

One of the great advantages of a broken grade with an 8% maximum is that it enables the locating engineer to dodge costly construction work such as rock cliffs, bad slides and swamps. A road surveyed on a 2% maximum grade in Fig. 4 would allow the locating engineer no opportunity to avoid costly construction. Even in the roughest mountain country half the highway will probably have less than 3% grades.

Rock-Dust Sampler

By Otto Ruhl*

The U. S. Bureau of Mines in its investigation of the rock-dust problem in metal mines has found the devices hitherto used in sampling the mine air for dust to be not wholly satisfactory. To remedy this, Edwin Higgins has devised an apparatus which seems to offer a satisfactory solution to the problem.



The Dust Sampler in Operation

The device was first used by him in his examination of the mines in the Joplin district. It consists of the following essential parts: (1) A glass bulb for catching the dust. This bulb is partially filled with graulated sugar. George A. Burrell, after considerable investigation and research, agrees with the South African authorities that granulated sugar is the most satisfactory medium for intercepting rock dust. The granulated sugar is prevented from passing into the sampling device by means of a perforated glass plate inserted in the bottom of the glass bulb. (2) A mouthpiece of an oxygen-breathing apparatus, with inhalation and exhalation tubes attached and including the valves which cause the air to flow in the proper direction. The mouthpiece is kept in place by the regulation cap, to which straps are attached. (3) A nose clip to prevent air from passing in or out of the nostrils. (4) A Draeger liter-bag, having a capacity of 35 liters.

The purpose of the device is to determine what weight of rock dust may be contained in a given volume of air. To take a sample, the apparatus is adjusted in the mouth with bulb and liter-bag attached; the nose clip is made tight on the nose and the sampler breathes naturally, the inhaled air passing through the sample bulb, where the dust is extracted, and the exhaled air passing into the liter-bag where it may be measured. After the sample is taken the sugar is removed from the bulb, dissolved, and the remaining dust collected and weighed. Thus the weight of dust contained in a measured volume of air is obtainable. The photograph shows the apparatus in use.

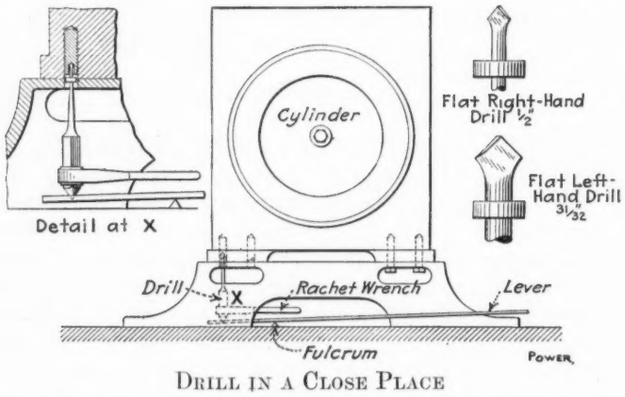
As to the accuracy of this device, it is probable that the exhaled air from the lungs occupies about $^1/_{50}$ less volume than the air that is inhaled. This is not an appreciable error. While the fact that from 35 to 40 liters of air may be taken at one sampling makes for greater accuracy, there is a small source of error in determining at just what point the liter-bag may be considered full of air. This is probably the most serious source of error, but it may be reduced to the minimum by practice in using the device. On the whole, it is believed that the device on account of the large volume of the sample it will take is accurate to within 2 or 3% under any conditions.

*Ruhl & Shanklin, mining and civil engineers, Joplin, Mo.

Replacing Broken Capscrews

A 22x42-in. corliss engine broke the capscrews that hold the cylinder on the pedestal at the crank end outside, and left about 1½ in. of stubs in the holes, says C. L. Juno in *Power*. The problem was to get them out in the shortest possible time.

A ratchet drill would not go into the space between the feet and allow the handle to work between the casting and the floor. There was a ratchet wrench at hand and



Drill in a Close Place

two drills were forged with square shanks to fit it. One drill was ½ in. and the other $\frac{31}{32}$ in. (the bolts were 1⅛ in.). The ½-in. drill was used first, then the $\frac{31}{32}$-in., which was ground to turn to the left. The object was to have the drill tend to loosen the stubs instead of tightening them.

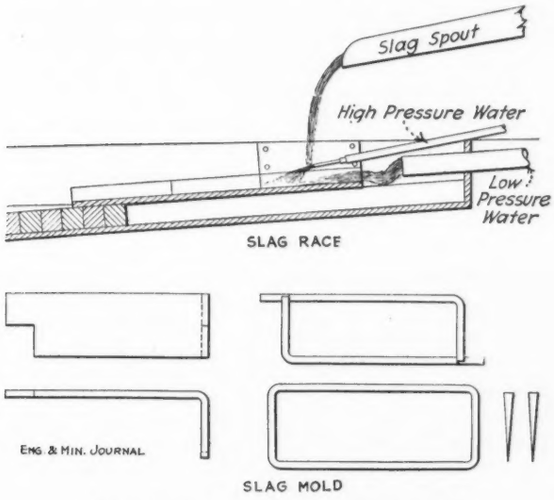
After about an inch had been drilled with the $\frac{31}{32}$-in. drill, the stub backed out, leaving a nice, clean thread. A long bar and fulcrum were used for the drill feed. The illustration shows the layout.

Details of Milling and Smelting

Slag- and Matte-Granulating Devices

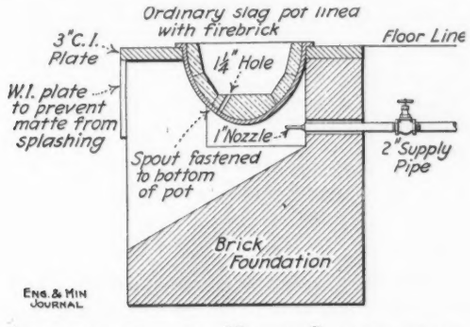
By Percy E. Barbour*

Two granulating devices are shown herewith, both of which have worked satisfactorily at a small smelting plant. The first was used for slag and the second for



Slag Race Made of Slag Blocks

matte. The slag race is lined with slag blocks made with the molds shown. The slag spout, nozzle and flushing launder and their functions are clearly indicated in the accompanying sketch. The matte granulator uses an old



Arrangement for Matte Granulation

slag pot lined with firebrick and set in a brick foundation. There is a hole in the bottom of the pot through which the matte flows and a nozzle directs the stream of water into it as it falls. The deflecting apron of the foundation diverts the granulated matte to the receiving car.

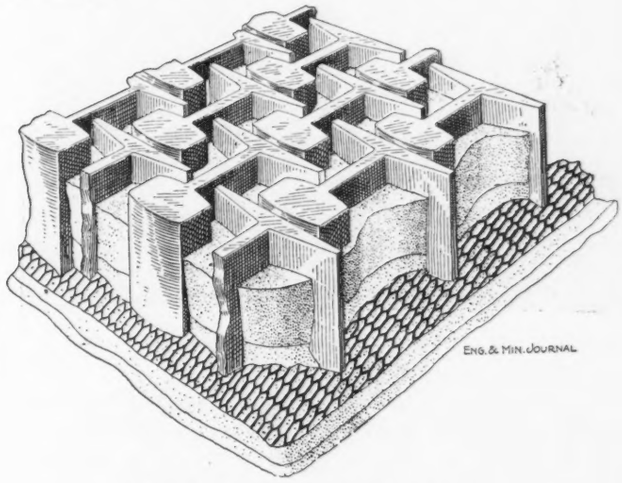
The Use of Lime Water for Precipitating Copper from Leaching Solutions has been patented by George B. Chittenden, of Chilito, Ariz. (U. S. pat. 1,104,410). This is claimed to be a great improvement on precipitation by milk of lime, iron, or similar reagents.

*Mining engineer, 887 Middle St., Bath, Me.

Britannia Tube-Mill Lining

A novel use of rails, so often useless adjuncts to a mine and mill scrap heap, has been suggested in a form of tube-mill lining, invented by Henry Berquist, of Britannia Beach, B. C. The Hardinge Conical Mill Co. is bringing out this lining, crediting the form to the inventor mentioned. The photograph on p. 240 was taken after one of the linings had been in use for about six months, and the report is that it would have at least another six months of life. It will be noticed that the open spaces between the rail sections are filled with an agglomeration of pebbles and other material. These have a tendency to hold the sections more firmly in place than when originally embedded in the cement.

The accompanying drawing shows the method of embedding the rail sections in the mill, the directions being furnished by the Hardinge Conical Mill Co. They are as follows:



Britannia Tube-Mill Lining

The interior of the mill must be thoroughly cleansed, especially from all traces of grease and oil. The mill shell should be absolutely clean, not merely wiped. A small quantity of cement mortar is mixed up, using one part of good portland cement and two parts of clean sharp sand, worked up to the consistency of thick paste. The cement is spread over a portion of the mill shell to a depth of about 1 in. The mill should be lined in sections running from feed to discharge openings. On top of the cement, place some type of wire screen, cut up in small sections, not to exceed 1x2 ft. Any flexible wire screen between 8 and 4 mesh will answer. That shown in the illustration is expanded metal lath, No. H, gage 27, unpainted. Press this wire cushion as deeply into the cement layer as possible. It is not necessary that the pieces of wire overlap, but the joints should be fairly close. The screen is desirable to distribute internal forces.

Over this a second layer of cement, approximately 1 in. thick, is spread on top of the wire. Then the rail ends are forced down into the cement as far as possible,

using even a light blow, if necessary, thus forcing the metal cushion still further into the cement bed. The rail ends should be arranged as nearly as possible in the order shown in the illustration, using 3½-in. or 2½-in. lengths. The 3½-in. length is better in a cylindrical mill. When half the mill is finished, another layer of cement is put in up to about 1 in. of the top of the rails. This is allowed to set and the lining of the other half of the mill finished in the same way.

The principal points in setting this lining are the care that the mill shell is clean, that the cement does not take any set before being used, that the rails once embedded are not disturbed in any manner, that the rails are forced into the cement bed as deeply as possible, that all crevices between the rails are well filled within 1 in. of the top, and that the lining is well set before the mill is put into operation. Mills equipped with this lining should be operated for several hours with half a charge of lump ore before any balls or pebbles are put in, in order to fill the remaining crevices, thus forming a cushion.

BRITTANNIA TUBE-MILL LINING

A New Process for Heating Blast-Furnace Stoves

The Pfoser-Strack-Stumm system for heating Cowper stoves was first described in November, 1913 (*Stahl und Eisen,* 1914, p. 305). Further notes were given in a paper by A. Spannagel in an Iron and Steel Institute paper, Autumn session, 1914.

If the flow of gas through a blast-furnace stove be increased beyond the normal, the temperature of the waste gas rises, and though the stove is heated more quickly, the efficiency falls. This, however, is true only up to a certain gas velocity. Beyond that critical point, the stove heats still more quickly, but the temperature of the exhaust gas falls, i.e., the efficiency is greatly increased.

The explanation seems to be that as stoves have ordinarily been run, the gas has flowed quietly through the channels in the checker work, only the outer layer of gas giving up its heat to the bricks by conduction, while the inner layers have had to get rid of their heat by radiation. If the velocity of the heating mixture be now increased, an eddying is caused in the gas current and more heat is conveyed by conduction, but since the quantity of gas is greater, a larger proportion of the heat is unused. But if the velocity be increased still more, the gas molecules are driven about so violently that in a short time all come in contact with the brick and give up their heat. As a result the temperature of the waste gas falls. At the same time the heating period is shortened.

In the original installation, the velocity of the gas was heightened by using an air blast at 12-in. water pressure as an aspirator. Just enough air was used to leave no excess of either oxygen or carbon monoxide. Using rough-cleaned gas (0.5 gram dust per cu.m. of gas) the heating period was shortened from 4½-5 hr. to 1½ hr., and the exhaust-gas temperature dropped from 700° to 350° for a blast temperature of 800° C. By using highly cleaned gas, the size of the passages in the checker work was reduced, and the exhaust-gas temperature was reduced to 90°-116° C., using air at 16-in. water pressure to aspirate the heating gas. At Neunkirchen, six blast furnaces will hereafter be worked with 15 stoves, of which not over 12 will be running continuously. The method is also applicable to Cornish boilers.

Fume Precipitation by Electrostatic Discharge

The use of a wire coaxial with a metal cylinder as electrode in the Cottrell process of fume precipitation has been known for some time. The active agent is the luminous corona surrounding the wire, which does not extend far. However, a method of extending this influence has been patented by W. W. Strong and A. F. Nesbit (U. S. pat. 1,120,561), assignors to R. B. Mellon, of Pittsburgh.

This they describe as follows:

In the use of an ordinary high-tension alternating-current corona discharge, we have found that under certain conditions the luminous region about the active electrode may be greatly extended by the introduction of a spark gap in series with the active or grounded electrode. The effect of the introduction of such a spark gap is used in wireless telegraph practice for the purpose of introducing high-frequency oscillations upon antennae circuits. It is well known that the frequency and damping factor of these oscillations depend upon various characteristics of the circuit including the momentary values of the resistance, the capacity and the self induction. It is therefore seen that the secondary ionization and the ionic currents of the corona may be increased by the use of a spark gap in the high-tension circuit and the aggregating action of the discharge is also increased. The insertion of even a single spark gap in series with the high-voltage circuit gives a very appreciable effect upon the precipitation produced. The length of the gaps and their positions relatively to circuits shunting them are factors which enable a nicety of adjustment of the electrical circuits for the purpose of controlling the precipitation. These facts have been determined by actual experiment. We have also found that, contrary to the usual view, iron-cored inductances may be used to exert a very noticeable adjustment of the circuits.

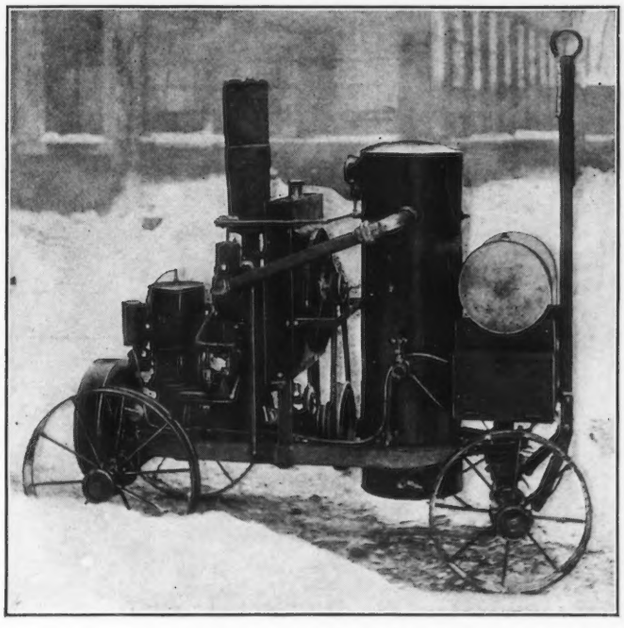
Ferrosilicon Production should be at a minimum of 1 kg. of the compound per kilowatt-day, according to Keller in "L'Eclarage Electrique."

Mining & Metallurgical Machinery

Portable Gasoline-Driven Compressor

The small gasoline-engine-driven air compressor here illustrated has been developed by the Ingersoll-Rand Co., particularly to meet the needs of the contractor doing work of a temporary character requiring compressed air in small quantities.

The compressor is operated by a simple single-cylinder gasoline engine, coupled directly to the compressor, both pistons working on the same crankshaft. The engine is of the single-acting two-cycle type, closely following well known marine designs. The compressor is one of the company's standard types, Imperial XII, with a capacity of 45 cu.ft. per min. at a pressure of 90 lb. It is fitted with an air unloader and the engine with a centrifugal governor.



PORTABLE AIR COMPRESSOR

Cooling is provided for by a gear-driven pump and an automobile-type radiator with large tank capacity, serving both the compressor and engine. The radiator is assisted by a large fan.

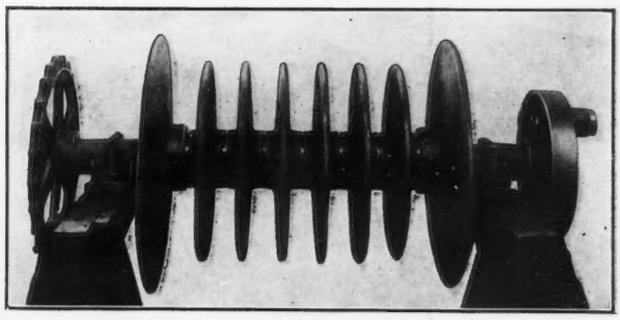
The frame, axles and wheels are of steel; the front axle is arranged with a swivel connection to the frame, permitting horizontal rotation and sufficient vertical movement to accommodate the wheels to inequalities of the road without strain on the frame.

An air receiver fitted with safety valve, pressure gage, necessary piping, outlets, etc., is hung at one end of the frame and a gasoline tank of 15 gal. capacity is supported on a large tool box, as shown in the illustration.

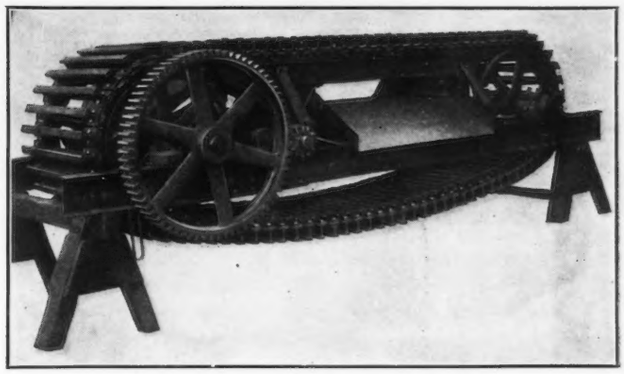
The outfit complete weighs 1600 lb.; it is designed for hand transportation, but can be fitted with tongue and singletree if desired. The company rates this outfit as equivalent in capacity to one Jackhamer.

New Types of Grizzlies

The capacity of a crusher operating on run-of-mine ore is frequently reduced by the amount of fines in the feed. If it is possible to bypass these fines, a saving in power and wear is effected, delays are reduced and the use of a smaller crusher is sometimes made feasible. If an automatic feeder is used the crusher can also work to capacity. A frequent arrangement of grizzlies and feeder is one in which the latter delivers over a 45° grizzly into the crusher, but this arrangement requires considerable headroom. To meet feeding conditions and overcome the headroom difficulty, two new types of grizzlies have recently been designed by the Stephens-Adamson Mfg. Co., of Aurora, Ill., and installed at the properties of the Hercules Mining Co., Kellogg, Idaho, and the Magma Copper Co., Superior, Arizona.



DISK TYPE OF GRIZZLY AND FEEDER



TRAVELING-BELT TYPE OF GRIZZLY

Those in use at the Hercules are the traveling grizzly bar feeders shown in Fig. 1. If any pieces become wedged between the bars, they are automatically released as the bars open up over the sprockets. The feeder is placed directly beneath the hopper opening so that the material rests upon the bars and its flow to the crusher is controlled by the motion of the feeder.

The situation at the Magma Copper Co. was somewhat similar to that at the Hercules, with the difference that there was no room for the traveling type of feeder. The rotary feeder and screen, Fig. 2, were designed for this case. It requires more headroom but less room horizontally than the traveling feeder. The larger rocks are held on the circumference of the disks and delivered into the crusher, while the fines pass down between the disks. The distance between the disks may be changed by adding or removing washers on the shaft between the disks. Lumps lodging between the disks are freed by stationary steel fingers dovetailing with the disks.

Motor Trucking Iron Ore*

Pierce-Arrow trucks are being used to haul the iron ore which the McIntyre Iron Co. is using in its experiment of smelting titaniferous ores at the Port Henry blast furnace. The mines are at Tahawas, in the Adirondacks, about 30 miles from North Creek, the nearest railroad station. At first it was attempted to transport the mining equipment by teams. One two-horse team carried two tons, and as it took three days to make the round trip, the cost was high. Two Pierce-Arrow five-ton trucks were purchased, and it was found that these two trucks could make two round trips per day carrying five tons of equipment at a much lower cost.

The next problem was to get the ore down to the railroad. A plan involving the use of three large traction engines with trains of snowsleds, carrying 250 tons per trip, was evolved. The plan called for a snow leveler going over the ground to the station, followed by a water wagon sprinkling on the softer parts of the snow, so that the road would freeze and allow the heavy traction engines and sleighs to travel over it with ease. This scheme was an utter failure; only 10 miles was actually traversed from the mine to the nearest point on the state highway; the traction engines were practically scrapped. It was found that they would carry only 40 tons per trip instead of the 250 tons originally expected.

George H. Pride then obtained a contract to haul the ore the remaining 22½ miles. He purchased seven five-ton Pierce-Arrow trucks fitted with shallow wood bodies having removable slides and tail gates. These trucks are now operated night and day. There is a mechanic in charge of the equipment, 16 drivers and 24 laborers for loading and unloading. The road is hilly, with a surface which is good, but which is cut up by small waves said to cause a synchronic vibration on the truck springs.

The total drop is about 1000 ft. The complete round trip of 45 miles takes 5¼ hr. Four trips per day seem to be about the maximum that can be secured with safety.

It has been found advisable to take off each truck in rotation and give it a complete examination by the mechanic in charge, to insure its working up to its highest capacity all the time. At the beginning, the use of trailers was attempted. It was found that they cut down the speed to about three miles per hour, and they were also extremely troublesome on grades, because they could not be braked satisfactorily. For these reasons, and also because of complaints that the highway was being cut up, it was decided to abandon the trailers entirely.

*An abstract from an article by John Younger, mechanical engineer, truck department, Pierce-Arrow Motor Car Co., Buffalo, N. Y., appearing in the July, 1914, issue of "The Pierce-Arrow Salesman."

Hardening Salts and Pastes

What are termed "sentinel" pyrometers, in the form of paste and metallic salts made into molecular mixtures that will melt down at different temperatures throughout the range from 220 to 1330°, have been developed recently by the Carl Nehls Alloy Co., Detroit, Mich. They are described in *American Machinist*, Jan. 7, 1915. One form of application is to cast the mixtures into solid cylinders, $\frac{7}{16}$ in. diameter and ¾ in. long.

Each one is wrapped in a paper on which is printed its correct melting temperature in degrees Centigrade. For all temperatures below 932° F., these salts can be used in air-tight glass tubes. The salts can then be used over and over again. By using small porcelain saucers the salts do not run to waste and litter up the place. This also enables them to be used several times, as the salt melts each time the temperature rises above the one marked on the cylinder, and becomes solid again the moment the temperature falls below this degree.

These salts are also made up in the form of paste. Enough to make several hundred determinations is packed in a tin. Pastes with various melting temperatures can be daubed along a steel bar and inserted into furnaces, ovens, retorts, flues, gas mains, steam pipes, and the like. The salts that melt and those that remain solid will indicate the temperature, which would be between the two.

Loading Ore on Trucks

Loading Ore into Railway Cars

The Manufacture of the Symons Disk Crusher has been taken over by the Chalmers & Williams Co., Chicago Heights, Ill., in addition to its former line of crushing machinery.

Herbert Clark Hoover

To the New York *World* of Jan. 17, 1915, Will Irwin, the well known writer, contributed an article about Herbert Clark Hoover, who needs no introduction to mining engineers and metallurgists. However, Mr. Hoover is as famous for his modesty and reticence as he is for his practical achievements, and consequently some of the personal touches of Mr. Irwin are interesting. In making some excerpts from his article, which we do with the courteous permission of the *World,* we have discarded some inaccuracies of his story and have limited ourselves to those things that are correct or those that look probable. Not included among the latter is the portrait of Mr. Hoover, with which the original article was adorned. That portrait did not look like Mr. Hoover at any time during our acquaintance with him in the last 10 years or so. Mr. Hoover is in fact quite averse to having his picture taken. At the time last year when he was presented with the gold medal of the Mining and Metallurgical Society of America, we were extremely desirous of publishing his picture, but no photograph was to be obtained, notwithstanding the considerable influence that we were able to exert in quarters near at home. So then, let us turn to Mr. Irwin's story:

We had in Stanford University, during the earlier, livelier days of that institution, a working student who found time not only to make his own living and to keep his scholarship high, but to run student-body politics, which were in those days complicated and ardent. As one looks back over his college days, he finds himself surprised not only at the college "phenoms" now occupying humble niches in life, but at the unconsidered individuals who have made names for themselves. That, I believe, is an academic platitude. But sometimes your college man runs true to early form; and I think most of us expected something from that quiet, grave and wise young man whom we knew as "Bert" Hoover.

His record in Australia came to the attention of those Europeans who were working with the Chinese in that brief dawn of progress which preceded the Boxer uprising. They made Hoover, at the age of 26, the expert of the North China Government. He was far in the interior, prospecting, when the rebellion broke. By good fortune he got to Peking alive, gathered up Mrs. Hoover and took her to Tientsin just as the Boxers laid siege to that town. For six weeks Hoover, Mrs. Hoover and a half dozen other Americans lived beneath a barricade of rice bags and sugar barrels, rather expecting death any day. Once, when the supply of defenders fell short, Hoover was enlisted to help man a machine gun, and daily Mrs. Hoover served tea at 4 o'clock to the foreign colony, sweetening the brew from the sugar that protected them from Boxer bullets.

The siege was lifted at last. But the Chinese Reform Government was gone, and with it went Hoover's worldly fortunes. That, his friends have remarked since, was as it should be. It was not fair that any man of 26 should be so successful as Hoover, before the Boxers flattened him out. Having nothing else to do for the time, Hoover joined the correspondents, and followed the allied armies into Peking. He helped for a few months in the reconstruction of the Chinese railroads, and when things straightened themselves out managed to get a coal concession. He took this to London, raised capital, and presently found himself established in the heart of the commercial world as a mining engineer and promoter.

From this point, his fortunes, through all those vicissitudes which always mark the mining business, have gone on and up, until now his interests are as wide as the world. He presses one button and it rings and starts a new shaft in Burma; another, and it shifts a gang in Australia; another, and it sets the wheels going in Mexico or China or California. One of his companies would doubtless be called "the Zinc Trust" in America; another involves the management of a principality in Russia. He is a specialist on organization. The best thing he does is to take a rundown property, below the line of dividends, and make it pay. Certain mining engineers have told me that Hoover is probably the most powerful and influential mining engineer in the world—and he is only 40 years old!

Whenever we write a European biography of these times, we must hereafter insert this line: "And then the war broke!" It broke in the mining business, as that business is run from London, with a deafening crash. It involved, it complicated, it ruined things to an extent which would have been ridiculous had it not also been so tragic. And just then, when such a man as Hoover needed all his brains and faculties for his own business life thrust a new responsibility upon him. The Americans were pouring out of the Continent to get home any way they could. Half of them were panic-stricken; half of them, in the first confusion, were practically without funds. Some one must straighten things out. A hastily-formed American committee began this work. But its chief executives had to go home in order to attend to their own affairs. Hoover found himself at the head of this committee, doing three men's work in getting 92,000 of his countrymen home to safety.

The full history of the American committee cannot be written as yet; it involves too many delicate considerations of diplomacy. But it was a whale of a job, take the word of one who listened to its troubles. Forty-two thousand of our refugees passed through its hands. Ten per cent. of them had to be helped financially. They came in irregular rushes, which must be distributed somehow among the steamship lines. No sooner was the delegation from the British Isles despatched than the crowd from Paris, ordered out when the Germans came to the height of their rush, arrived. No sooner were these distributed than the Americans began piling out of Germany.

The American Committee had to make itself a kind of regulator of popular desires. There were two classes of Americans in Europe last fall—those overeager to get away from trouble, and those who wanted to overstay their welcome. To the former class belonged that old lady who would not sail until Hoover gave his guarantee in writing that the Germans would not sink her ship. In this class too was the old negro who, when asked why he wanted a ticket home, wrote, "I take a great interest in my own country just now." To the latter class belong those women who, when the Germans came near to Paris, had to be forced into the train by their friends. Sometimes one class was in the ascendant, and sometimes the other; sometimes there was a rush for steamers, and sometimes steamers sailed with empty cabins. The committee was always soothing Americans or "throwing a scare into them," as the situation demanded. But by the middle of October, the American tourists had been cleaned out

of Europe, and the transatlantic lines had begun to withdraw steamers. Not an American remained in Europe for want of passage money. Two unfortunate American children, who wandered with their mother into the Russian trenches in East Poland, died of exposure. Otherwise, no American lost his life as a result of the war.

That did not end the work of the committee, however. The European Governments found use for this neutral body. Thousands of German schoolgirls were shut up in England, thousands of English schoolgirls in Germany. The Governments agreed to exchange these prisoners; and the American committee took charge of this work. American women chaperoned and escorted the girls back and forth. Before December Miss Daisy Polk, of San Francisco, made six such round trips. Then, too, after the fall of Antwerp and Ostend, the Belgian refugees began pouring into London. The English were not yet ready for them, and the advance guard was received and relieved by the Americans.

Here Hoover should have returned to his business. But immediately life walked up and handed him another responsibility of charity. Belgium, as all the world knows now, is starving, and America alone can feed her. The Americans in London, occupying a strategic position as "neutral citizens" on the border of the trouble, are the logical persons to handle the transmission of supplies. They formed the Commission for Relief in Belgium—and again Hoover, with his executive ability and his creed of efficiency, was the logical man for active Chairman. He settled down to that job, and he is at it on this date of writing. Within three weeks after he settled down to work, Hoover, with one set of associates in New York, another in Rotterdam and another in Belgium, had perfected a system of shipping, checking and distribution which is a model of its kind. Men of other races might have built up such a system, give them time, but only an American, working with Americans, could have done it in so short a time. It is the old story: If you want a thing well done, pick the busiest man you know. Presently the work of the commission grew until it became the largest commissary undertaking the world ever saw—feeding nearly 7,000,000 people from supplies three to five thousand miles away.

Being an American, Hoover has the sense of humor common to us all, but he still hides it under that grave exterior of his college days. He talks little, but he thinks much, and straight to the point. Efficiency is his hobby and work his recreation. But he has found leisure for friends; and no man on earth has a more interesting assortment. The Hoovers live at Red House, an old manorial establishment, built in Georgian days when Kensington was open country. Now it lies behind a wall, which conceals its English garden and its antique gables from the crowds of Greater London. Thither, in old times, before this war, came these friends, world-wanderers all, as to a harbor in their wanderings. They ranged from Alaskan "mushers" to Chinese mandarins, and the conversation at Red House made a story book seem thin and commonplace.

There is little of such life for any one in darkened, anxious London nowadays; and least of all for the group of Americans who are feeding Belgium. Twice since November Hoover has taken the trip to Brussels, which involves, nowadays, a deal of hardship and some peril. The rest of his nights and days he is struggling with shipments and food purchases. Social, diplomatic, governmental notables crowd the anterooms of the Commission's offices. A thousand schemes to raise enthusiasm and subscriptions are being conducted under his supervision. The last heard from him in New York, he was thinking of going into Belgium again.

"And I'm frank to say I dread it," he said. "I can't convey the things you have to see."

Nechi Mines (Colombia) Ltd.

In connection with his report on Pato Mines (Colombia) Ltd., W. A. Prichard also reported on the property of Nechí Mines (Colombia), Ltd., to the directors of the parent company, Oroville Dredging Co., Ltd. The Nechí, or San Francisco, dredging ground is across the Nechí River from the Pato mine. The Nechí property will be operated by the Pato company's managerial staff and supplied with power by that company. The ground has been prospected by 41 drill holes, the first of which were sunk under the direction of the Pato management while the last few holes were drilled under the supervision of Mr. Prichard.

The dredgeable area as prospected to date is estimated to be 89¼ acres of an average depth of 47.6 ft. and an average value of 71.86c. per cu.yd., or a total of 6,855,900 cu.yd., having a gross value of $4,926,600; the field operating cost of dredging, on the basis of one dredge operating on Pato for six months, and two dredges on Pato after that period, is estimated by Mr. Prichard at $554,472, showing a net return of $4,372,128 or £900,000, approximately.

In estimating the drill-hole results on the Nechí property a theoretical drill factor of 238 ft. of hole to the cubic yard was used, a lower value than was taken in the Pato estimate where there was an opportunity to obtain corroborative results with the dredge. The fineness of the gold on the Nechí property was determined at 860, by assay.

South of the drilled ground there is a swampy area that has not been sufficiently drilled to determine its value. A few holes that were put down indicate the probable existence of a few acres of dredgeable ground. The tested ground of the Nechí property lies along the south side of the river and on the opposite bank in the Pato property, three drill holes have indicated a similar gold content. Hence, it is suggested that the auriferous gravel, which lies at considerable depth, extends right across under the bed of the river. As there are upward of 40 acres of river bed at this point Mr. Prichard recommends that a test therefore be made. The Nechi company's title, originally issued in 1858, is said to antedate that of the French concession covering the river channel.

Up to the time of the purchase of the property by the Nechí company the native owner was working the bench-gravel deposits in a small way. These bench gravels have the appearance of being of sufficient size and value for profitable working by hydraulic methods. Mr. Prichard recommended that the mine staff investigate the bench gravels at a favorable time.

The Nechí dredge will have a steel hull, and was ordered in England from Fraser & Chalmers; it will be a close-connected 7½-cu.ft. bucket dredge. The hull arrived in Colombia in November, 1914, and is being assembled

near the Pato machine shop. The machinery for the dredge was delayed by the war, but at the recent meeting, Chairman F. W. Baker announced that, unless unforeseen contingencies arose, the dredge was expected to be completed by July, 1915. The hull was being constructed above ground and will be launched into the Nechí river before the machinery is placed upon it. It will only have to cross the river when completed to reach the dredging ground. The dredge is designed to dig to a depth of 55 ft. below water level and to handle a 10-ft bank.

The Nechí dredging ground contains less clay than Pato, and, being deeper, the buckets will average fuller than on the Pato dredge. The buckets on the Nechí dredge, while of only 7½-cu.ft. capacity, as against 8½-cu. ft. on the Pato dredge, are expected to handle as much or more yardage than the Pato. The Nechí dredging area is agricultural land with few trees and the cost of clearing should therefore not exceed $100 per acre. Pond water will be obtained by connection with the Nechí river, thus avoiding the cost of pumping pond water as at Pato. Mr. Prichard estimates that the Nechí operating costs on a basis of 100,000 cu.yd. per month, will average not over 9c. per cu.yd. for the period during which one dredge is working in Pato, and 8c. when two dredges are operating in Pato; these estimates include 2c. per yd. for bullion-realization expense, or more than double the Pato expense for this item.

The chairman stated that the estimated earning capacity of the Nechí preperty, based on the treatment of 100,000 cu.yd. of gravel per month, estimated to yield 71c., and allowing for an operating cost of 10c., would be £146,000 per annum. The property was purchased for £10,000 and other expenses incident to purchase and examination amounted to about £4000, while £50,000 were provided for working capital and equipping the property. The funds necessary to acquire and equip the Nechí property were effected by the formation of a company with a capital of £140,000; it is consequently estimated that the dredge will be earning 100% or more, every year, on the capitalization.

California Mineral Exhibit, Panama-Pacific Exposition

The California State Mining Bureau will exhibit at the Panama-Pacific International Exposition. About 400 sq.ft. of floor space in the Mines and Metallurgy Building will be devoted to case exhibits of California's mineral products. All mineral producers wishing to exhibit are invited to communicate with the State Mineralogist, Ferry Building, San Francisco.

The Engineering Foundation

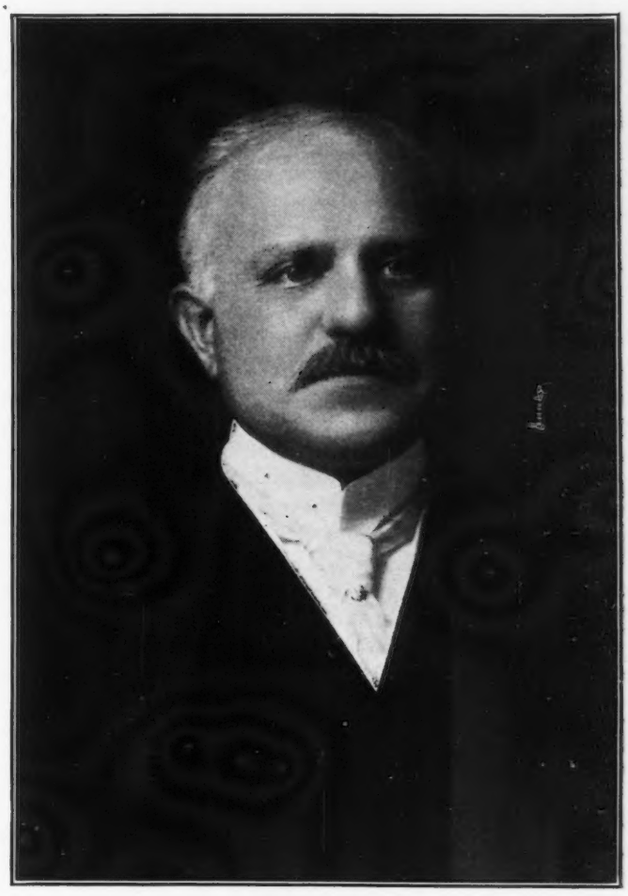
The establishment of a fund to be devoted to the advancement of engineering arts and sciences was mentioned in the JOURNAL of Jan. 23, 1915, p. 200. The engineer who gave the initial gift is Ambrose Swasey, of Cleveland, Ohio, who devotes $250,000 to this purpose. This was announced at a meeting on Jan. 27.

A New Allotropic Modification of Sulphur is suspected by A. H. W. Aten, who reports in "Zeit. physik. Chem.," 1913, LXXXIII, 442, that the enhanced solubility in sulphur monochloride of sulphur previously heated to 170° C. points to the presence of a maximum of 5% of a new allotrope, which, however, has not been isolated. Similar solubility relationships hold for carbon bisulphide and toluene; and all the solutions are yellow.

Daniel Guggenheim's Testimony

The testimony of Daniel Guggenheim to the U. S. Industrial Relations Commission, sitting in New York on Jan. 21, attracted a great deal of attention. It was given in the presence of a large audience.

Mr. Guggenheim was asked by Chairman Frank P. Walsh to give a list of the corporations in which he and his brothers, Murray and Solomon, are directors. Mr. Guggenheim mentioned the American Smelting & Refining Co., the Chile Copper Co., American Smelters Securities Co., Nevada Northern Ry., Yukon Gold Co., Mexican Union Ry., the Guaranty Trust Co., and the Guggenheim Exploration Co., as some of the concerns in which he is personally a director. Murray Guggenheim



DANIEL GUGGENHEIM

is a director in the New River Collieries Co. and the United States Zinc Co.; Solomon Guggenheim in the Braden Copper Co., Electric Boat Co., Electric-Dynamic Co., Industrial Oxygen Co. and Interborough-Metropolitan company.

"The laborers of each plant are under the direct control of the general manager," testified Mr. Guggenheim in speaking of the plants of the American Smelting & Refining Co.

Up to 1912, when his health became somewhat impaired, he himself visited the numerous plants of the companies in this country, getting to each one about twice a year. He kept posted on labor conditions in each mine and smelter. His associates on the board of directors and in the executive committee were similarly well in-

formed respecting what was going on, the executive committees meeting at least once a week and the sub-committees almost daily.

"All the members of the executive committee," he said, "are thoroughly familiar with the business and in thorough sympathy and in touch with the men. When I became ill, other directors went to our plants, getting to each one about every 30 or 60 days. The directors are responsible for labor conditions on our properties. Our directors are somewhat different from those of most other corporations, especially those on the executive committee. They have been brought up in the business and are thoroughly acquainted with it technically. In the event of labor difficulties the general manager of the plant communicates with the officers here, stating the conditions."

"What have you done to help your employees?" asked Mr. Walsh.

"Up to a year and a half ago," Mr. Guggenheim replied, "we did what we could to remedy conditions and make improvements. I told the members of the executive committee and board of directors that we should do more than we had done—we should see to housing the men better, relieve the conditions under which they worked, establish a pension fund—try to throw a helpful, encouraging light into their lives. It meant better business—a higher efficiency.

"We wanted a man who could take full charge and who understood labor thoroughly, and go about to see that what was needed. We engaged Dr. C. P. Neill, U. S. Commissioner of Labor. We wanted suggestions from him. We had elected to adopt the compensation acts in all places where we have works and the elective laws have been enacted."

"Did your company oppose the passage of any of them?" asked Mr. Walsh.

"We did not," answered Mr. Guggenheim.

"We have been experimenting in our Perth Amboy plant on insuring our workers, single and married, so that from $500 to $1000 is paid in the event of death. We have also improved the housing of the men and their sanitary conditions.

"My province in the company as president is to suggest its policy," said Mr. Guggenheim. "Our directors are in sympathy with improving the working conditions wherever possible and within reason.

"I am a member of the labor committee of the A. S. & R. Co. When we hear that conditions are bad in this or that plant the matter is brought to the attention of the executive committee and an investigation ordered, and if the conditions are found to be bad, the conditions are changed."

"Do you recall what your men in the Perth Amboy plant were paid when they went on strike, in 1912?"

"I do not. It may have been $1.60 a day or $1.80. As soon as the trouble arose I directed Willard S. Morse, a director, to go to Perth Amboy and study conditions and try to remedy them and do all he could. Our efforts in that were rewarded. Mr. Wilson, then Governor of New Jersey, sent a member of his staff to Perth Amboy, who telephoned me when the difficulty was settled that he was highly pleased, not only with Mr. Morse's work, but with the spirit of the company.

"The directors of our companies do not shirk the responsibility they feel is theirs. Whenever any of our directors go to the plants they talk with the workers. At Perth Amboy Mr. Morse discussed the questions with many of the men. Some of them with whom he talked were unable to make clear what they wanted, as they didn't seem to know.

"I would not say we have frequent strikes. You must consider that the men are restless because of the high cost of living. I sympathize with the men affected by the increased cost of necessities and I do what I can to help them."

"Do you oppose the policy of organized labor?"

"Employees are fully justified in organizing. Often the capitalist is arbitrary—just as the laborer is, at times. I have no objection to what our employees do outside the plant. They are human."

"Do you think industrial discontent is increasing?"

"I think it is on the increase and fear it will continue to increase unless something is done to prevent it. The high cost of living is partly responsible for that, but the greatest canker known to the world is envy. A man these days sees so many things to invite his envy. But envy is a pretty well distributed trait.

"I think we are getting to a higher standard in dealing with labor, just as I think the world today believes it is no longer necessary to kill off your competitor to get along; or grind down your fellow man.

"There is not enough legislation. I am not one of those who complain that our statute books are cluttered up with useless laws for changing this and that. We are many years behind England and Germany in legislation which helps the workingman—the poor man.

"There is today too great a difference between the rich man and the poor man. To remedy this is too big a job for the state or the employer to tackle single-handed. There should be a combination in this work between the Federal Government, the State, the employer and the employee. The men want more comforts—more of the luxuries of life. They are entitled to them. I say this because humanity owes it to them."

"Do you think the workingman should have a voice in the arrangement of the conditions under which he labors?"

"The workingman should have not only a voice—he should have a compelling voice. The workmen's compensation act was won by the workingman. He will win more legislative victories. And legislation that will benefit the many is desirable, no matter what that legislation is."

"I think the state should furnish work for the men who lack employment. You may call me socialistic, if you like, but it is a job of the United States to look after its people. Were it not for philanthropic work there would be a revolution here.

"But sufficient is not given in this case. People won't give up money they make easily, even though they have more than they need.

"So the government must raise the money—raise it by taxing the estates of the rich, if you will—but the United States must raise it some way.

"An evil of philanthropy lies in the fact that its proposed beneficiaries feel themselves placed in the light of paupers. Thousands of persons are too proud to accept help unless they can give something in return. Many of them prefer to starve. They want help—money—but they want to work for it.

"In the scheme of uplift in which we are all interested,

I think, I believe the workers are entitled to share in the profits in all industries. This should be so arranged that the money could be taken in bulk at the end of the year and deposited to their account in a banking institution. If that were done it would change conditions in thousands and thousands of homes.

"Workers, in the mass, do not understand how to save. My method would teach them. It would be the same as teaching a child to read and write. The people in this country who have built up fortunes in the last 10 or 15 years have done it because they have been thrifty. Many are poor because they did not save. Sometimes, of course, fortunes come without thrift, as in the case of the son of a worthy or unworthy sire. The sons of the rich, in many cases, are entitled to sympathy, though I would not say as much sympathy as the poor.

"I prefer conciliation instead of arbitration. Labor and capital will never get together when there is trouble if both sides are equally strong. I have always felt that conciliation can do more than compulsory arbitration, but legislation would do away with both. The laborers must organize to accomplish this object.

"We have in our plant the so called 'open shop.' Every man has a right to be heard as an individual or as the representative of an organization. We do not discriminate. A man may belong to a union or not as he pleases. Of course, we will not let any union organization walk into our plants and tell us what we shall do. We have to use reason. We have the interests of our shareholders to consider.

"We do not think we have a right to control a man any more than we have a right to say what he shall eat or drink.

"I believe we get better results from the big organizations than from the small corporations, because there is a better chance to eliminate incompetency and arbitrary methods."

Chairman Walsh tried to draw out Mr. Guggenheim on the nature and extent of the philanthropic work he supported, but Mr. Guggenheim modestly avoided pursuit of the inquiry in that direction, saying, "Oh, I do not want to advertise."

Colorado Metal Mining Association

The second annual convention of the Colorado Metal Mining Association was held at the Brown Palace Hotel, Denver, on Jan. 11, 12 and 13, with President Bulkeley Wells in the chair. The session opened with the reading of the reports of the president, secretary and treasurer, which were ordered published for distribution. Governor Ammons addressed the meeting and in the course of his remarks said he believed mining was destined to retake the high place it formerly occupied in the state and become of even greater importance. Governor-elect Carlson then addressed the association and urged the mining men of the state to unite in opposing measures of national conservation which would tend to thwart the best interests of the state. He advocated a greater degree of cooperation between the State Geological Survey, the Bureau of Mines, the Colorado School of Mines, and the members of the mining fraternity, to insure the rapid growth of the mining industry. Special attention was called to the bill before Congress for the adoption of a leasehold system for mining property, and the people of Colorado were urged to stand together in suppressing such legislation. It was the unanimous opinion of the association that a leasehold system would repel capital and retard mining development indefinitely.

Resolutions were adopted protesting against the leasing of public lands and demanding a more equitable system of taxing mining properties. Numerous other resolutions were adopted and committees were appointed to draft suitable bills and confer with the governor thereon.

Carl Schnabel

Prof. Carl Schnabel died recently at his home in Berlin, in the 71st year of his age. Schnabel was one of the most distinguished of German metallurgists. Of his early life we know relatively little. In 1877 he was assistant superintendent of the silver-lead smelting works at Lautenthal in the Harz. In that capacity he developed his well known process of treating with carbonate of ammonia the zinc-lead oxides obtained by steaming liquated silver-lead crusts. A plant for this process was erected at the works, and for a time Prof. H. O. Hofman, now professor of metallurgy in Massachusetts Institute of Technology, was in charge of it. This process was in operation for several years, but it was found to be too expensive and had to yield to the distillation process that is now in use everywhere. If my recollection be correct, Schnabel's process was also used at the great silver-lead refinery at Hoboken near Antwerp.

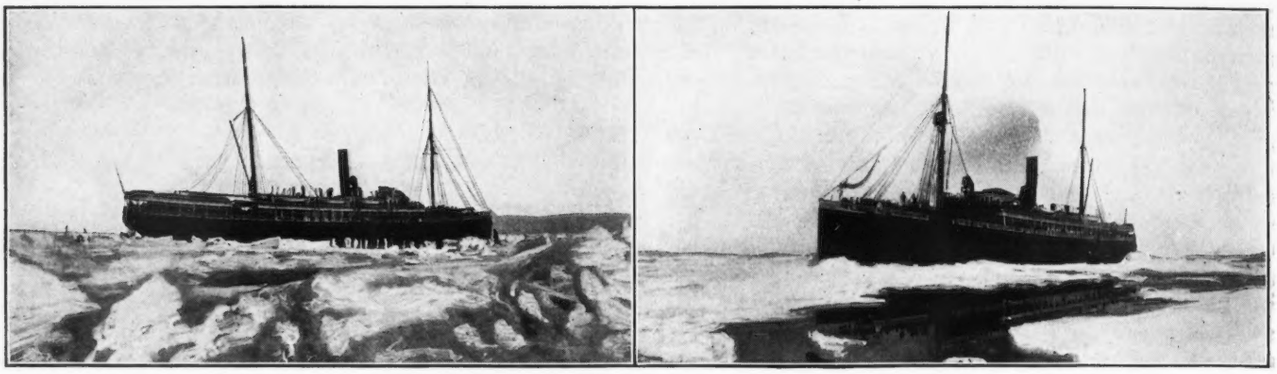
While at Lautenthal Schnabel obtained his degree of doctor of philosophy from Jena. From Lautenthal he was called to Clausthal to fill the chair of professor of non-ferrous metallurgy. He remained at Clausthal a great many years, and while there wrote his well known treatises, especially his "Handbuch der Metallhüttenkunde," which became one of our metallurgical classics and has been translated into English. During his vacations Schnabel also did professional work, his most famous commission being in the early '90s when he was called to Broken Hill, New South Wales, to make a report upon the treatment of mixed sulphide ores.

As a teacher at Clausthal, Schnabel was a great success. He was a man of fine appearance and magnetic personality, a fluent and lucid lecturer, and professionally a master of his subject. He was popular among his students with whom he fraternized, and for whom he was the leader, not merely from the lecture platform, but on the ground among them. Schnabel was a very human man. The pilgrimages to Lautenthal, Langelsheim, Oker, and the other metallurgical points of interest in the Harz, followed by a social gathering in some congenial place, are events that are fondly remembered by old Clausthalers.

Upon the death of Bruno Kerl, the dean of German metallurgists, Schnabel was called to the technical school to Berlin to take his chair, which he occupied until he was obliged to retire, on account of poor health, when he was pensioned by the government. Schnabel was a big-minded generous man, and to the writer of this note he gave examples of his fine professional spirit that are warmly remembered.

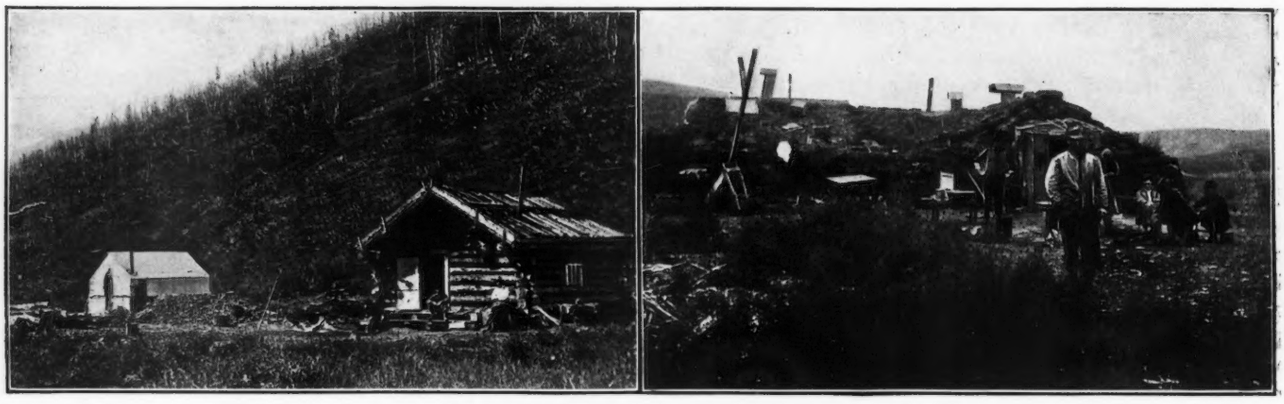
W. R. I.

Photographs from the Field



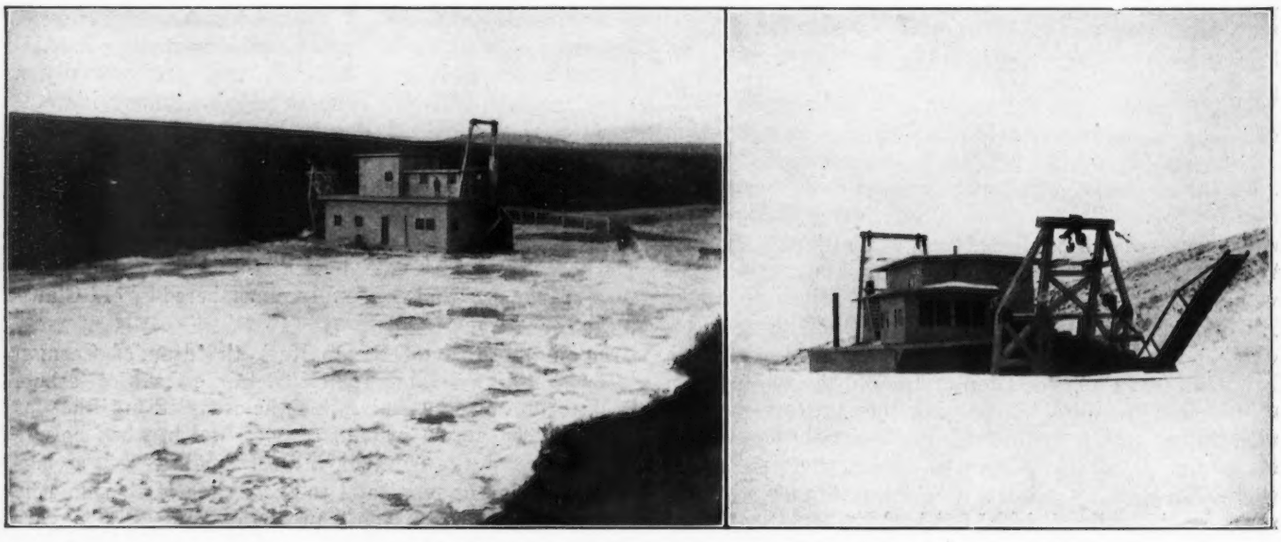
APPROACHING NOME, ALASKA, IN MIDSUMMER

Steamship "Senator" standing in the ice off Nome on June 10, 1914. The ship brings passengers and freight for the dredging fields and mining districts



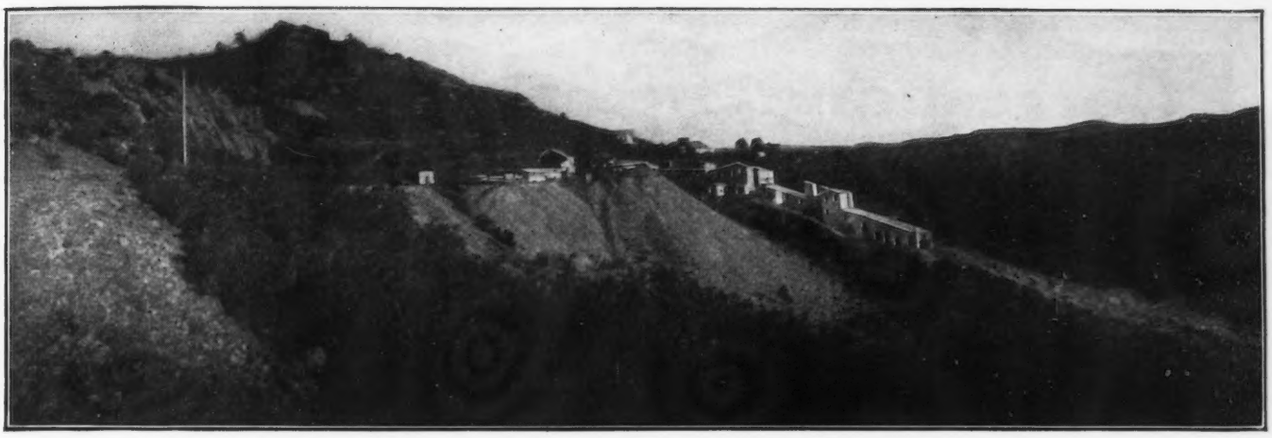
DREDGE MINERS' CABINS IN ALASKA

The log cabin is in the Innoko district, and the stone and sod cabin is on the Inmachuck River

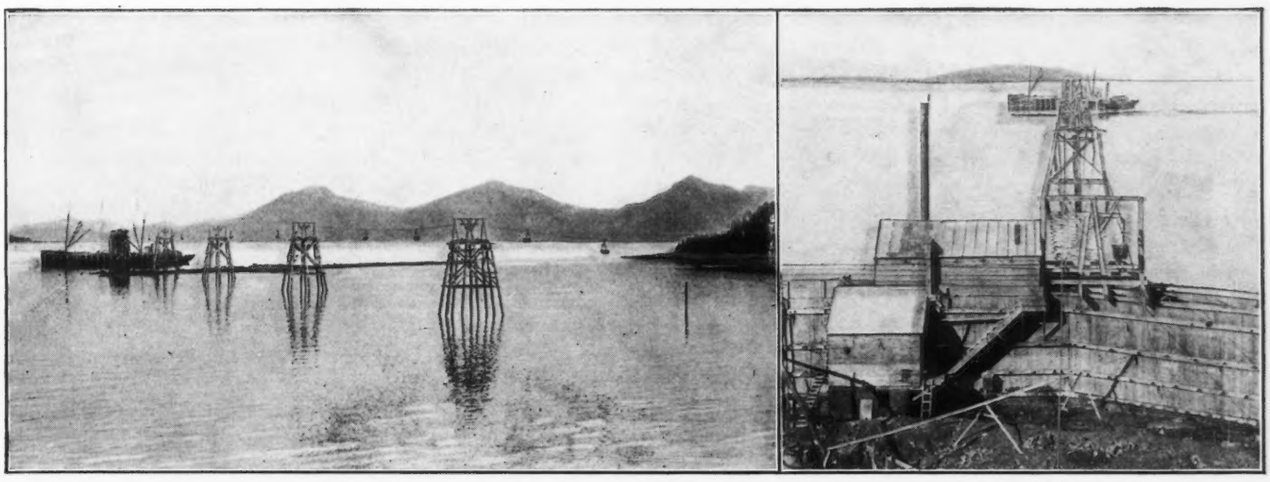


RUBY DREDGE IN THE CASADEPAGA RIVER, ALASKA

The dredge is shown operating in the late fall when the ice is closing in, and shut down in winter, completely frozen in



PLANT OF THE SOCORRO MINING & MILLING CO., MOGOLLON, N. M.
This company is now spending a large sum of money in the development of hydro-electric power for operating mine and mill



LOADING DOCK AND ROPEWAY OF THE ELLAMAR MINING CO., ELLAMAR, ALASKA
2200-ft. transportation system to facilitate loading of deep-water vessels

CONCENTRATOR OF THE KENNECOTT MINES CO., KENNECOTT, ALASKA
Not at present in operation. Company is shipping high-grade ore. Aërial tramways connect the mill with Jumbo and Bonanza mines. The company owns what is probably the largest existing body of high-grade copper ore

Correspondence and Discussion

Why Is the Patent Mania, or Why Is the Patent Office?

When the number of patents issued by the United States passed 1,000,000, the daily press and some scientific periodicals alluded to the fact with considerable pride as indicative of American ingenuity. The number of patents issued by this Government, according to the *Patent Office Gazette,* is now averaging about 700 a week and the total number issued by the end of the year will approximate 1,122,000.

If one will take the trouble to look up the patents on any one subject, he cannot help but be amazed at the duplication and overlapping of claims, and the question at once arises—why do intelligent men rush to the Patent Office with every slight variation in a process or mechanical appliance that they must know cannot be sustained in the courts as an original discovery or invention?

It cannot be for fame or even cheap notoriety, for the *Patent Office Gazette* performs only the function of a dictionary and patents receive but passing notice only in the technical publications devoted to that particular subject. Far greater publicity and credit could be obtained by the publication of such discoveries or inventions in the technical press or society proceedings.

It cannot be for pecuniary gain, for a little experience and no great amount of reasoning will soon destroy any visions of coupons. Germany is credited with the best patent code in the world. Dr. B. C. Hesse* in speaking of the coal-tar industry for which Germany is noted, says: "From 1877 down to the close of 1912 there were taken out in Germany 5675 German patents, or 158 per year, dealing with the utilization of coal-tar hydrocarbons and their byproducts; it has been estimated that not more than one out of every hundred has secured financial return for its owners. During the years 1895 to 1903, 382 German patents, or at the rate of 48 per year, were taken out in inorganic chemical industries."

I think it is reasonable to assume that the financial returns from the patents granted by the United States, taken as a whole or on any one subject, will not exceed the percentage obtained from coal-tar products in Germany, and it is doubtful if out of the 1,122,000 issued, 11,000 have been profitable to the patentees. Judging from the character of many patents issued in the metallurgical industry, the chances for reward are infinitely better in lottery tickets.

This desire, then, to obtain a patent on every trivial modification of a process or device seems to be something akin to a mania for an object really unknown, unless it is a personal gratification that may come from the securing of patents, however worthless they may be. Is not this mania producing a foolish and serious obstacle to the progress of metallurgy?

Let us look at the other side. Some years ago I was talking with an engineer who is connected with one of our large metallurgical companies. He told me in detail of a patent he had applied for and later secured on a metallurgical process. I remarked that every step in his process was already covered with patents or had been in common use for a long time. He said, "I know it, but you know it is possible to string together a number of patents or old ideas and secure a patent on the combination. This will have no intrinsic value, but will serve as a club to keep the other fellows off."

Shades of Efficiency and Economy! If patents were really worth anything and royalties collectible, where would be the ultimate consumer? The very multiplicity of patents defeats their object and makes them worthless.

A patent was recently obtained on a furnace by an engineer connected with another metallurgical company. This furnace was already patented as a whole and in detail from feed to discharge and the patents held valid and operative by the furnace company. The "improvement" consisted of a coal-feed hopper attached to the furnace and the use of the furnace for another purpose, neither of which was original with the patentee. The patent could not possibly be sustained by the courts and was probably taken out as a defensive movement on the part of the company.

Just now, in metallurgical lines, copper leaching and flotation processes seem to be rampant. A few years ago the craze was centered on concentrating tables and cyanide filters. A consulting engineer told me a few months ago that he has 20 patents on the use of sulphur dioxide in copper leaching and electrolytic precipitation. He admitted that they are of little value except as a defense. I happen to know of several other metallurgists who hold a number of patents on the same subject respectively. Without taking the trouble to look them up, I would not be surprised to find 50 or 100 patents expired and in force on this one process alone. The same is probably true of flotation processes.

While engaged in professional work, I wished to use granulated pig iron for a certain purpose and had it made at a local foundry. "American Foundry Practice" told us it could be best granulated by a jet of steam, which was found to be very satisfactory. I was afterward told the process was patented. In fact, it seems impossible to take up any line of work nowadays without being surrounded by patents of little or no originality, but which frequently serve as a means of annoying (to say it politely) and expensive litigation to operating companies who are doing a legitimate business and adding knowledge to the art, provided the patentee can secure financial aid to prosecute his claims.

I do not mean by this to defend individuals or corporations who, by their power, are able to take advantage of a financially weak patentee and infringe on a valuable basic patent by securing patents on slightly modified details, but since it seems possible for any number of

*Lecture delivered before the College of the City of New York, May 1, 1914; "Met. and Chem. Eng.," September, 1914.

people to secure a United States patent on substantially the same thing, it is only natural that corporations and individuals have resorted to this method of defense from blackmailing litigation.

A number of years ago I had to fight an interference on a basic patent all the way to the Supreme Court. We were sustained in every decision. Within less than six months after our patent was granted, if I remember correctly, the Patent Office had granted our opponent two patents on the same process. It seems to me our patent laws have been reduced to an absurdity and that branch of our government has become what Washington called the Congress of the Federated States, "a nugatory body." If American ingenuity is measured by the number and quality of patents issued, the average value of that ingenuity is very low.

There are countries where patents are easily obtained because there is little native ingenuity and the governments need the money, but that is not the case with us. It is not to be expected that any one man or an average group of government officials can be fully informed on every branch of industrial effort, but the securing of an American patent should be an achievement to be coveted as a mark of ingenuity, and our government can well afford to maintain, at adequate salaries, a sufficient number of expert examiners who are qualified to pass on each industry represented in the Patent Office. The laws should be so revised that only basic principles or radical improvements are patentable. Trifling modifications, grouping of old ideas, and other juvenile features that menace progress of an art, should be eliminated entirely.

Real inventions and improvements are valuable and real inventors should be rewarded. Capital is willing to pay for such at any time. Let the profession coöperate to secure the world's highest standard for American patents.

STUART CROASDALE.

Denver, Colo., Dec. 21, 1914.

Steel Balls vs. Flint Pebbles

The editorial in the JOURNAL of Dec. 26, in regard to the use of steel balls vs. flint pebbles in tube mills, raises an interesting question whether means for the removal of fine iron particles from the ground pulp might not only extend the use of steel balls for crushing pulp intended for cyanidation, but might also permit balls of a less expensive kind of steel to be used than manganese and chrome steel.

I recall that I built a magnetic separator a number of years ago for this purpose for a cyanide mill in Mexico, but as the order was placed through a foreign commission house, and the engineer in charge was, I believe, a Spaniard, I was unable to get in touch with the results obtained. I have, however, felt that this subject is worthy of further study and investigation. It is probable that from ½ to ¾ lb. of metallic iron per ton of pulp is added to the ordinary quartzose ore from ball mills, and probably ¼ lb. more from the coarse-crushing machinery, such as jaw crushers and rolls.

This fine iron is in the form of minute flakes and scales. Its form makes it peculiarly difficult to separate from wet pulp, but I believe it can be done successfully by means of a type of machine especially designed for the purpose. The successful removal of the fine iron thus holds out promise, both of increasing the capacity and also of reducing the cost of crushing and milling ores intended for cyanidation.

C. Q. PAYNE.

New York, Jan. 8, 1915.

California Redwood for Tanks

We noticed an extract from the JOURNAL of Dec. 19, 1914, in the San Francisco *Chronicle*, referring to California redwood and its uses, particularly in the form of tanks.

Regarding the reason for the resistance of redwood to acid liquors, we have always supposed this was due to the fact that redwood contains an acid itself which neutralizes the other acids. This acid is particularly noticeable in green stock fresh from the saw. When anyone handles this green stock one's hands are stained with black, which is very difficult to get off. This is due to the acid. In the dry stock this does not occur.

The presence of this acid also helps to preserve the wood from decay and from rot influences. This is the reason why it has proved so satisfactory for pipe line, silos, foundation lumber, tunnel timbers, etc. It may interest the JOURNAL to know that we have recently closed a sale for 7½ million feet of redwood ties for India, this wood having been selected because of its long life under trying conditions.

J. H. BROWNE, General Sales Manager,
The Pacific Lumber Co.

San Francisco, Calif., Dec. 29, 1914.

[The idea of an acid neutralizing other acids will probably not appeal forcibly to the chemist. However, this is an interesting problem for anyone objecting to the statement. Why is redwood so resistant?—EDITOR.]

The Utilization of Tin Scrap

I note in the JOURNAL of Dec. 26 the remarks on the utilization of tin scrap. I have acted as chemist to one firm engaged in this industry in England and it may interest the inquirer to know that in London there are at least three firms engaged in "burning" solder off old tin cans and one in completely detinning old tin cans by, I believe, an electro-chemical method.

The chief difficulty in the business appears to be the cost of collecting the old tins and the disposal of the detinned iron, which still contains a trace of tin.

A. H. MAUDE.

Vancouver, B. C., Jan. 4, 1915.

Rapid Discharge for Tube Mills

In the report of the Consolidated Gold Fields of South Africa for the year ended June 30, 1914, I notice the statement that it has been found possible materially to increase the crushing capacity of tube mills by means of a scoop discharge at the outlet end, which lowers the level of the fluid pulp in the mill. The result of such a device seems to me to be similar to the rapid-discharge type of mill known in this country, and not different from the older peripheral-discharge type. If better results are to be secured through such means, our pet theory of the point of "critical moisture" is all upset. What new theory has been formed to take its place?

A. Z. JONES.

Philadelphia, Penn., Jan. 15, 1915.

Editorials

Copper in Germany

The contributions upon the subject of copper in Germany that we published last week and publish this week come from authoritative quarters, and give a correct and complete picture of the position of copper in Germany. Briefly, the situation is this:

Copper is scarce in Germany and but relatively little has been obtained from the outside. The high price, officially 22c. per lb., is sufficient evidence of this. On the other hand, the scarcity is not so great as to attract general public attention. Our own correspondent does not mention it at all, but dwells especially upon the scarcity of gasoline and kerosene, two things that are of more immediate importance to the public generally than is copper. The scarcity of copper is rather adverse in its influence upon the building trades, and is causing remarkable attention to the adoption of substitutes.

It is clear from Mr. Werner's statement that the shortage of copper has not materially affected the military operations. Yet the army, like everybody else, is cautioned to be sparing in the use of copper. It is also clear that the Mansfeld mines have not yet been able materially to increase their production, although it is expected that they will ere long be able to meet the military requirements. We may infer, therefore, that the military requirements are somewhat in excess of 4,000,000 lb. per month, which is about the normal production of the Mansfeld mines.

The argument of Mr. Werner that the adoption of substitutes for copper in Germany is going to have a permanently bad effect upon the copper producers of the world, especially the American, strikes us as disingenuous, and does not leave a very good taste in the mouth. He says in effect to the United States: "Embroil yourself with Great Britain, or Germany will forever afterward be no customer of yours."

We do not believe that permanent substitutes are readily going to be found for what has heretofore been considered the indispensable metal, although temporary substitutes there may be. We have experienced times of destitution in expeditions when we have had to make fire with flint and steel, but we were very glad to revert to the use of lucifier matches when we could get them. The substitution of aluminum wire for copper wire has been talked about during many years, but has failed to make any great headway; and we do not believe that the manufacture of belt buckles out of zinc instead of copper is going to reduce the consumption of copper by anywhere near so much as when the automobile manufacturers discontinued brass trimmings and fittings a few years ago.

Anyway, it seems to us that a condition that prevents American copper from going to Germany is the embargoes on copper shipments that have been decreed by Norway, Sweden, Denmark, Holland, Italy, and Switzerland, which comprise all the gateways to Germany. Even if Uncle Sam wanted to twist the lion's tail real hard, he would find other barriers to open by persuasion, or break down by force.

An American Metallurgist in the Chile Nitrate Field

Charles Butters is not only one of our most distinguished metallurgists, but is also one of our most enterprising metallurgists. One of the latest examples of his irrepressible activity comes to us in the news that the nitrate industry of Chile is just being awakened by him to the importance and applicability of the vacuum filter in its work. A correspondent in Chile writes to us that this means opportunities later for technical men who have had experience in the handling of sand and slime; and he expresses the opinion that in less than five years after peace is declared, a thousand cyaniders will have found work in the Chilean nitrate business. He adds, that the time might be shortened by about four years and six months if an immediate market could be found for Chile's nitrate product.

Chile is so far away that but few Americans know more than vaguely what is going on there. In fact, the great export business of Chile is in sodium nitrate, about two-thirds of the output of which was taken by Germany. When the German purchasing of sodium nitrate was cut off by the war, the Chilean nitrate producers suffered far more disastrously than did the copper producers. As compared with what the interference in these trades meant to Chile, the experience of the American copper and cotton producers was only a mere taste.

The way to help ourselves in developing a Chilean trade is first to help Chile. There are great possibilities there. Let us consider a modern nitrate plant, as built up to the time when Mr. Butters entered the field. It consists of crushers, conveyors, elevators, cars, rails, locomotives, carts, electrical and steam plants, steel tank work, structural steel by the hundreds of tons, piping (steel, wrought-iron and cast-iron), pipe fittings and valves, shovels by the thousands, mules, harness, lumber, corrugated iron, complete machine shop, foundry and repair equipments, evaporators, wire rope, boilers and steam accessories running into a few thousand horsepower for the treatment tanks, air drills, dynamite and accessory explosives, jute bags (Antofagasta requires 20,000 per day), and so on, for pages. One of the recent plants of a certain large company has twelve 20x12-in. Blake-Marsden crushers. There is not a Gates or any other gyratory crusher in any of the nitrate plants.

However, the nitrate producers of Chile manifestly cannot buy these things unless they are able to sell their nitrate. The United States takes some of the Chilean nitrate for its own agricultural purposes, and ought really to have a larger share in supplying the Chilean producers with what they need than has heretofore been the case. But in order to capture that business fully we ought to use more nitrate of soda in this country; in other words, our farmers ought to be induced to use more. Incidentally, we should then be helping ourselves in another way, inasmuch as if our farmers could be persuaded to

use fertilizers more freely, they would not only require nitrate of soda, but also the derivative of phosphate rock, which heretofore we have been exporting so recklessly to Europe, and our producers of which are now suffering because their market is cut off. This seems to be the time of all times when every state agricultural bureau and everybody interested in the development of agricultural resources should unite in a great propaganda to extend the use of commercial fertilizers. In so doing the United States would not only improve its agricultural position, but also would develop a great South American trade for its manufacturers and would open new channels of employment to thousands of its citizens.

The Flotation Process

Everybody has, of course, noticed the dearth of discussion about the flotation process in the current technical literature. The explanation of this is the still unsettled patent litigation and the attitude of Minerals Separation, Ltd., the claimant. That company will neither permit its own employees to talk or write about the process, nor will it permit the employees of its licensees to do so. We do not recollect any metallurgical process of broad application and use respecting which such efforts toward secrecy have been exerted and so far have been successfully maintained. Toward that end no stone is left unturned. For example, a flotation apparatus is introduced somewhere for experimental purposes. The experiments finished, the apparatus, which is essentially a construction of timber, is destroyed with axes. Naturally those concerns which are employing the flotation process without license from Minerals Separation and are liable to be called into court, keep their mouths shut as a matter of policy.

This situation is likely to prevail until a final decision in the Hyde case is rendered by the Supreme Court of the United States. In the meanwhile the suit against the Miami Copper Co. is being prosecuted vigorously and is expected to come up for trial in Delaware this spring. This suit is expected to bring into court review the Callow and the Towne systems of flotation.

The flotation process as practiced is a matter of delicate adjustment. With any given ore experiments may fail to give any promise whatever, simply because of failure to conform to some essential, and usually simple, condition. The size of the ore, the quantity of the feed, the temperature, etc., must all be just right, and especially must regularity of feed be attended to carefully. The fundamental features of the treatment also vary according to different ores. Thus, in floating the blende of Butte the addition of acid is necessary. In floating the copper ore of Miami the presence of acid is fatal. The character of the oil used also varies according to the ore. In the treatment of the zinc-lead ores of Broken Hill eucalyptus oil is commonly employed. In the treatment of the zinc ores of Butte, pine oil, a product of wood distillation (analogous to the eucalyptus oil of Australia) is generally used. Sometimes a little oleic acid is added. In the flotation of copper minerals heavier mineral oils are used. The choice seems to be more or less dependent upon what it is desired to accomplish. In the concentration of copper ore the aim is to extract all the copper possible and if considerable gangue is dragged out with it, no great harm is done. In the concentration of blende, however, the production of a high grade of concentrates is more important than the extraction of the maximum possible percentage of zinc. Therefore a lighter, more delicate oil is favored. In some processes of selective flotation some oils that are very light indeed are used. We have touched upon a few of the important points in connection with this process that ought to be discussed in technical literature, but probably that is not to be expected so long as the shadow of the litigation is over us.

The Pato Report

W. A. Prichard's report on the Pato property of the Oroville Dredging Co., reprinted elsewhere in this issue, will doubtless be read with much interest by those who follow dredging matters. There has been considerable discussion from time to time of this enterprise but much of this was beside the mark, because few data were available upon which intelligent discussion could be based. Pato was in the nature of a pioneer enterprise as most of the dredging operations in Colombia had previously resulted in failure. The Pato management encountered many difficulties, and naturally the first few years were disappointing in actual returns, although the real value of the property was at no time in question.

As a result of Mr. Prichard's drilling, the tested area of the property has been extended from 310 to 528¾ acres, having an average depth of 26.3 ft., an average recoverable value of 31.6c. per cu.yd., and a total yardage of 22,419,490. The tested area is thus nearly doubled, while the average value of the original area is maintained. Mr. Prichard's report is replete with interesting data both of a specific and general character that will be of much assistance to other engineers who may have occasion to investigate or direct the operation of properties in what may be called a virgin field for the dredging operator.

It is pleasant to record that after several trying years, Oroville's Colombian enterprises now promise an ample and satisfactory profit. Mr. Pritchard estimates a net return of over five million dollars for Pato and of over four million dollars for the Nechí property across the river. It is interesting to note that the latter property was purchased by Oroville for £10,000, and that the expenses of examination and equipment will bring the total cost of the property only to about £64,000, whereas the estimated profit from the Nechí dredge is over £140,000 per annum, with a yardage already proved sufficient to last about six years; this does not consider the Nechí River bed, nor the bench gravels that may be amenable to hydraulicking.

The statement of the United States Steel Corporation for the final quarter of 1914 shows the lightest net earnings ever reported for a single quarter; and completes a year in which the earnings were also the smallest ever made. The only annual statement approaching that for 1914 was in 1904. The dividend on the common stock, which had been reduced previously from 1¼ to ½%, was omitted altogether, and a draft on the accumulated surplus of $5,736,743 was needed to make the payment on the preferred. The result was not unexpected. The reaction from the too heavy buying of 1913 had just begun to pass, when the upset of credit and business due to the war sent down trade to a low point, and low prices failed

entirely to stimulate it. The business of the Steel Corporation simply followed the general course of the steel trade, and its losses were probably even greater than those of its independent rivals.

BY THE WAY

A dialogue according to the *Inland Printer*: "How's your latest gold mine panning out?" Fake promoter: "Beyond expectations. Why, old man, it's assaying over a thousand suckers to the ton of literature."

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We have several times remarked how the zinc-smelting works of Belgium and Poland had happened to be in the region of military operations, while those of Silesia and Galicia were in such close proximity to regions of fighting that they also be threatened. We little thought that anything of that sort might happen to a British smeltery, but the works of the Central Zinc Co., at Seaton Carew, near the Hartlepools, were in the zone of the bombardment of the German squadron which recently raided the British coast. Fortunately the works suffered no damage, but an 11-in. shell fell and burst in a field at the back of the manager's house. The incident led to the removal and internment of the German and Austrian workmen who, up to that time, with the sanction of the government, had been kept at work, under strict military control, because the continued production of spelter in England is of importance in the public interest, and there was no sufficiently skilled English labor to take their place. How far it will now be possible for the Central Zinc Co. to continue its operations to the full previous extent is doubtful, but every effort is being made to that end. Meanwhile, the works are being increased as far and as fast as labor conditions allow.

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The valuation of the estate of the late Herman Frasch, as filed in the office of the State Controller, Nov. 18, is $5,261,276. This is a respectable total representing Mr. Frasch's earnings from his two chief accomplishments, the discovery of methods for desulphuring Petrolea and Lima oils; second and chiefly his successful working of the Louisiana sulphur deposits, after a number of others had failed. Indeed it was to his management of the Union Sulphur Co. that most of his fortune was due. It appears from the statement of his property that Mr. Frasch was not a believer in real-estate investments, his entire fortune being in securities and cash. His judgment as to stocks was good, by the way, nearly all of those which he held being of the gilt-edge variety. Of those which we would naturally expect to find are American Agricultural Chemical Co., 1000 shares valued at $93,000; Virginia-Carolina Chemical Co., 1485 shares, $46,742; Standard Oil Co. of New Jersey, $700,000; Union Sulphur Co., 505 shares, appraised at $2250 per share. The last item is of interest, as the first valuation we have seen of Union Sulphur stock.

⁂

A great mine that was pronounced a failure but was converted into a great success by the persistence of Grant B. Schley, of New York, who is now the controlling factor, is heard of but little. This is the Britannia, in Howe Sound, British Columbia. At a recent meeting of the Institution of Mining and Metallurgy, Mr. Trewartha-James told briefly of the history of this enterprise. The company had been exploiting this mine for a number of years, and had spent something like $3,000,000 without any profit. Mr. Schley, from long study of the subject in all its details, arrived at the conclusion that before he abandoned the mine he would put in two or three adit levels at considerable depth beneath the great orebodies which they had not been able to work profitably above, and of which large quantities of available tonnage remained. The engineer in charge of the mine, declined to be responsible for driving these deep tunnels, and resigned his post because he saw no prospect of attaining a useful object thereby. The result of that exploitation at depth was to make the Britannia mine one of the most remarkable mines on the West Coast, one of the great profitable producers of copper, and that "forlorn hope" has become of the utmost importance, not only to that company, not only to that district, but to the whole science and art of mining on the Pacific Coast.

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The question of a new property for Stratton's Independence, Ltd., was discussed at the recent annual meeting in London. It is estimated that the company has about two years' ore supply from July 1, 1914; however, some of this ore is so low in grade that it is not practical to determine, except by mill sampling, its value. The company has in hand about £20,000 for the purpose of handling a new property if one of a sufficiently attractive character should be placed before it. The chairman announced that during the last year Consulting Engineer Argall had under consideration from 30 to 40 prospects; 56 mines had received more careful attention, 45 being turned down after examination and casual inquiries; 10 mines had been visited, partially examined and sampled; and one mine fully examined and sampled and a complete report prepared upon it. For this property, Mr. Argall had not been able to negotiate terms which he could recommend to the company for acceptance. He desired an option arranged for a sufficiently long period to enable the proposition to be placed before the shareholders in general meeting. Leopold Salomons, holding nearly 30,000 Stratton shares, wrote to the chairman objecting to the acquisition of another property by the directors, but as the proposition is to be submitted to the shareholders at a general meeting, all will have an opportunity to express their opinion as to the desirability of acquiring another property and continuing in a business for which they are now well equipped.

⁂

David H. Browne, metallurgical engineer with the International Nickel Co., has achieved high distinction as being the successful developer of coal-dust firing applied to reverberatory copper smelting, although Mr. Browne himself properly gives credit to S. S. Sörensen as being the pioneer, and to the late Charles F. Shelby as being the first disciple. The work of Messrs. Sörensen and Shelby paved the way for what Mr. Browne, Mr. Howard and the Anaconda metallurgists have later accomplished. Mr. Browne has the gift of terse and witty expression. There are numerous examples of this in his recent paper in the transactions of the American Institute of Mining Engineers. One of the best is his characterization of the vicious circle of between products in old metallurgical practice. Speaking of the production of flue dust in for-

mer times at Copper Cliff, he remarked: "But little flue dust was produced, and this, following the time-honored custom, was wetted down and put back with the charge. Whether the flue dust really smelted, or whether it was worn out by being chased around in a circle, was a problem that troubled no one." Further on in his paper, Mr. Browne suggested that the low temperature of the gas at the throat of the Copper Cliff reverberatory, 922° C., might be criticized by Western smelters who usually have 1200 to 1300° at that point. Mr. Browne explains this, however, by telling that the heat of combustion is well utilized in smelting ore along the side walls, and consequently the escaping gases, having done more work than is usually the case, are relatively cold. "The function of a reverberatory furnace is to melt ore, and not to raise steam," he remarks, "and for this reason the more heat that is absorbed from the coal gases in the furnace, the more efficient the operation and the cooler the escaping gases."

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J. A. Comer & Co. (incorporated), metallurgists of Seattle, have published a pamphlet that we have read with a great deal of interest. The company (capitalization $1,000,000) was organized as a holding company, acquiring stock interests in other companies that may be started to operate with the methods supplied by the holding company. One such subsidiary—the Noble Metals Co.—is installing a plant at Seattle that is expected to turn out 30 tons of concentrates per day. It is said that the metallurgists and chemists connected with J. A. Comer & Co. have given years of study to the special treatment of ores of the entire group of noble metals "and their success in extracting and saving values far in excess of what can be saved by usual methods places them in a class by themselves in the metallurgical world." Yet, J. A. Comer, the chief metallurgist, does not claim to extract larger values from all ores than are extracted by other competent metallurgists. He claims merely that by special treatment he has demonstrated hundreds of times that values from two to 10, and even as high as 20, times that shown by usual methods of assay can be extracted and saved commercially by his process. Supporting this claim some examples are given: Ore from Porcupine gave $20 by the "old fire assay" and $212 by the Comer assay. Ore from Vermont gave $4 and $36 respectively. Alaska ore gave $2.50 by the "old fire assay," $24 by the Comer assay and $11.80 by the Comer commercial treatment. Massachusetts pudding stone gave $1.60 by the "old fire assay" and $24 by the Comer assay. The foregoing data appear on the buff paper of the pamphlet, the prospectus of J. A. Comer & Co. (incorporated). In some following white pages, J. A. Comer becomes personal, thus:

Does the Fire Assay Extract the Values from All Ores? I answer—NO.

I realize when I make this statement that I am going contrary to all teachings, all practice, and condemning a theory that is accepted the wide world over as being infallible. This is not the first time pet theories have been upset, nor will it be the last.

I may get ridden on a rail
Or perhaps tarred and feather instead
But a principal that is right will prevail
No matter what may be said.

We must acknowledge that Mr. Comer has thus disarmed criticism, but what gets our goat is that Massachusetts pudding stone.

The Prospector

By Berton Braley

My pick is stuck in my belt loop, my pipe is stuck in my face,
I'm off to the snowy mountains, I'm moving from place to place,
With the clear cool air about me and the chance of a "strike" ahead,
And all of my cares and troubles back in the town I've fled.
Smoking my strong tobacco, humming my happy song.
I'm off on the search for the gold I've hoped, the gold I have sought for long;
But whether I find it or fail once more, whatever my fate deems best,
At least I'll have been on the hike again and sated my deep unrest.

By day in the barren gulches, or up on the snow field's sheen,
Or wandering through the valleys, all quiet and cool and green,
With an ice-cold torrent tumbling over the rocks and sand
And maybe a cordial rancher to shake me by the hand,
With a welcoming, "Howdy, stranger, would you care for a bite with me?"
Then a supper of spuds and bacon whose savor is heavenly,
And night comes over the mountains, and the heights and peaks assume
A dim and a vague translucence, like shadows of stately gloom.

Sometimes with no walls about me, no roof but the sky above,
I lie in my army blanket and—ponder on life and love?
Well, no, I pull on my briar, I'm held by the night in thrall
And I watch the thin smoke melt away and think of nothing at all.
Peace to the wide world's worries, they are millions of miles afar,
They look as distant and small to me as the uttermost tiny star,
And the nightwind brushes my temples and drowsy visions creep,
Into my idle, carefree brain—and then comes a dreamless sleep.

My pick is stuck in my belt loop, my pipe is stuck in my face,
I'm off on another prospect, hoping that I may trace
Some vein of the yellow metal, or even the red or white,
And never was heart more eager, and never were hopes more bright,
What if I never strike it? you ask with a pitying smile.
Why, friend, the very searching is many times worth the while,
For it lifts my troubles from me and I know from the very start,
That one sort of gold I am sure to gain—the gold of a carefree heart!

PERSONALS

A. Chester Beatty arrived from London on Jan. 23 and will be in New York for a few weeks.

Frederic Kemble Brunton is making an examintaion of the Copper King mine near Clarkdale, Arizona.

Charles M. Schwab, president of the Bethlehem Steel Co., is reported to have secured another large contract for material for export.

Ward Paine, assistant to the president of the Copper Range Consolidated Co., is in the Lake Superior country visiting the property.

Frank McM. Stanton, of the Wolverine and Mohawk mines in Michigan, has returned to New York after a three weeks' inspection of property.

Howland Bancroft has just returned from an extended trip into British Columbia and is now engaged in professional work in Colorado.

N. V. Hansell, of Hamilton & Hansell, New York, sailed on Jan. 23 for Europe. He expects to visit England, Russia, and the Scandinavian countries before returning to New York.

Professor Joseph Daniels, of the Mining Department of the University of Washington at Seattle, has gone to San Francisco to take charge of the state mineral exhibit at the Panama-Pacific Exposition.

O. H. Tittman has been elected president of the National Geographic Society in place of the late Henry Gannett. He is superintendent of the United States Coast and Geodetic Survey, was one of the founders of the society and has been vice-president for five years.

C. A. Filteau, Colorado School of Mines, 1906, who has spent the last two years in the interests of American capitalists in Japan and Korea, has been appointed general manager of the Inca Mining & Development Co., Carabaya, Puno, Peru, and has sailed from New York for his new post.

The City of Philadelphia, acting on the recommendation of the Franklin Institute, has awarded the John Scott Legacy medal and premium to Dr. Charles Edouard Guillaume, of Sevres, France, for his alloy invar. This alloy consists of 63.8% Fe and 36.2% Ni, and has a coefficient of linear expansion of only 0.0000004 per degree centigrade.

Walter Hicks Clingerman, of Scottdale, Penn., has been chosen president of the H. C. Frick Coke Co., to succeed the late Thomas Lynch. He has been general superintendent for 10 years past. Clay F. Lynch, son of the late president, and recently general manager of the Bunsen Coal Co., of Illinois, succeeds Mr. Clingerman as general superintendent.

Walter Harvey Weed is in Butte, Mont., having gone out on professional work. Mr. Weed's offices and those of the "Copper Handbook" have been moved from Houghton, Mich., to 29 Broadway, New York. Mr. Weed contemplates making a "Mines Handbook" out of the "Copper Handbook," including gold, silver, lead, zinc, manganese, tungsten, bismuth and vanadium mines. The new volume will appear sometime during the present year.

Allen L. Burris, president and general manager of El Paso Consolidated Gold Mining Co., Cripple Creek, Colo., has resigned his office, giving as his reason that "at a called meeting of the company's board it developed that the directors did not agree with my policy. Since the burden is too heavy for me with disagreements, I have tendered my resignation as president." The disagreements related to the cause for the depression in the recent price of the company's stock in the markets.

OBITUARY

Henry Gurney Morris died at his home in Philadelphia, Jan. 19, aged 75 years. He was widely known as an engineer and a constructor, especially of motive power. He was born in Philadelphia, and graduated from Harvard University. He became a member of the firm of Morris, Tasker & Co., and later was the founder of the Southwark Foundry. He was one of the first directors of the Pennsylvania Steel Co. He was a member of the American Society of Mechanical Engineers, of which he was a past vice-president; the Engineers' Club, of which he was past president; the American Institute of Mining Engineers; the American Society of Civil Engineers and the Franklin Institute of Philadelphia. A widow and three sons survive him.

SOCIETIES

University of Washington—The "Short Course" in mining opened Jan. 4 with an enrollment of about 30, including a number from Alaska.

American Institute of Mining Engineers—The annual meeting of the Montana Section for the election of officers will be held Feb. 5. The regular informal dinner at the Silver Bow Club, Butte, Mont., will precede the meeting. The business and technical session will be held at 8:30 p.m., in the parlor of the Silver Bow Club. The following papers will be read and discussed: "1. The Concentrator of the Timber Butte Milling Co.," by Theodore Simons. "2. The Boulder Batholith of Montana," by Paul Billingsley.

American Electrochemical Society—The New York Section on Feb. 5, at the Chemists' Club, New York, will hold a joint meeting with the Society of Chemical Industry and the American Chemical Society. Subject of the evening: "The Electrochemical Production of Dye Stuffs and other Organic Products." Speakers: F. A. Lidbury, Oldbury Electrochemical Co., Niagara Falls; Harold Hibbert, Mellon Institute of Industrial Research; Geo. S. Forbes, professor of electrochemistry, Harvard University. The discussion following the reading of the papers will be opened by Dr. Leo Baekeland.

American Institute of Mining Engineers—The annual meeting of the Colorado Local Section was held at the Savoy Hotel, Denver, Jan. 16, following a dinner. Officers were elected for the ensuing year as follows: Chas. A. Chase, chairman; S. A. Ionides, vice-chairman; C. L. Colburn, secretary. Following the business meeting an address was delivered by Dr. R. B. Moore, of the United States Bureau of Mines, on "The Rare Gases of the Atmosphere." Tubes of the rare gases were exhibited and interesting experiments were performed. Interesting facts were related in connection with the discovery of these gases and the development of our knowledge thereof. About 40 members were present.

Canadian Commission of Conservation—The sixth annual meeting of the Canadian Commission of Conservation was held at Ottawa, Jan. 19 and 20, Sir Clifford Sifton, chairman, presiding. His opening address dealt mainly with matters relating to agriculture, forestry and the pollution of streams. Rhys D. Fairbairn, of Toronto, presented a paper on "Technical Education." Dr. Frank D. Adams, of McGill University, Montreal, in a paper dealing with the "Conservation of Mineral Resources," stated that the most serious waste in Canada was in connection with the mining and subsequent treatment of coal and with obtaining supplies of natural gas. Dr. Eugene Haanel, Canadian director of mines, in a report on non-metallic minerals referred to the Alberta oil fields, stating his opinion that the discoveries so far made and the prospects of future finds did not afford any guarantee for investments. A number of other papers were read.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

SULPHATIZING—Process of Sulphatizing Ores. Archibald D. Carmichael, West Norfolk, Va., assignor of one-third to Henry Schuyler Montgomery, Norfolk, Va. (U. S. No. 1,124,696; Jan. 12, 1915.)

SULPHIDE ORES—Process of Treating Sulphide Ores and Other Metallic Sulphides. Kristian Birkeland, Christiania, Norway. (U. S. No. 1,121,606; Dec. 22, 1914.)

TIN—Improvements in and Relating to a Process for the Recovery of Tin by Conversion into Volatile Tin Compounds. A. Richards, London, Eng. (Brit. No. 8611 of 1914.)

TIN—Process for the Production of Tin or Tin Compounds from Pyritic or other Tin Ores, Tin-Ore Concentrates, Tin-Waste, Tin-Plate Waste, Stanniferous Slag, Tin-Slag, and the Like. Jan. Rueb, The Hague, Holland. (U. S. No. 1,124,174; Jan. 5, 1915.)

TUNNELS—Lining for Tunnels and for Shafts. George Henry Dunlop, Brisbane, Queensland, Australia. (U. S. No. 1,125,013; Jan. 12, 1915.)

WELDING—Method of Electric Welding. Charles H. Kicklighter, Atlanta, Ga. (U. S. Nos. 1,123,308; and 1,123,309; Jan. 5, 1915.)

ZINC—Process of Removing Zinc from Zinc-Coated Material. Josef Weber, Essen-on-the-Ruhr, Germany, assignor to Goldschmidt Detinning Co., New York, N. Y. (U. S. No. 1,122,340; Dec. 29, 1914.)

ZINC FURNACE. Otto Ernst Ruhoff, Madison, Wis. (U S. No. 1,121,874; Dec. 22, 1914.)

Editorial Correspondence

SAN FRANCISCO—Jan. 20

The State Mining Bureau has concluded to place an exhibit in the mining and metallurgy building of the Panama Pacific Exposition. This would have been done earlier, but as usual the funds of the bureau have not been equal to such extra expenditure as would enhance its usefulness. Mr. Hamilton, state mineralogist, will detail a competent mining engineer from his staff to attend and take charge of the exhibit, and furnish information to visitors. The bureau has a large display of the various ores and minerals produced in California, which has attracted a great many visitors in the past, and which is in fact one of the most complete exhibits in the West. A large part of this collection will be placed in the space provided at the exposition. It will serve the purpose of instruction as to the varied resources of California. It will not be confined to a selection from the mining bureau collection, but will include also exhibits from owners of mines and individual collections. It was at first decided that a special effort would be made to attract visitors to the mining bureau at the Ferry Building, but it would probably have been unsatisfactory to adopt this plan, because people coming to the exposition for the purpose of seeing mining exhibits among other things, are not likely to spend much time looking about San Francisco for other similar displays of the mineral resources of the state.

Protection of Oil Lands menaced by infiltration of water will be undertaken by a bill to be presented in the state legislature. Some time ago representative of men requested State Mineralogist Hamilton to prepare a bill and submit it for their consideration. The oil men were in favor of district control, which is already in force in a voluntary way in the Midway and Coalinga fields. The objection to the law authorizing the formation of districts is, that it does not compel such formation, leaving it to the pleasure of the oil men interested in the districts. Many of the oil men desire legislative compulsion. Mr. McLaughlin, in charge of the petroleum department of the mining bureau, drew a bill for such compulsory district formation and submitted it to a meeting of oil men and representatives of the Senate committee on oil industry, at Sacramento, Jan. 15. Serious objection was made to this bill, although no one representing the oil men or the Senate committee seemed to have any better to offer. A meeting was held at the State Mining Bureau on Jan. 21. This meeting was better attended. The state mineralogist presented an entirely different bill providing for state control. This bill also met with some opposition. Some of the oil men insisted upon the district plan, but as on the previous occasion they seemed to have no definite method to suggest. It was decided that the bill for state control and the bill for district control should both be published for the consideration of oil men all over the state. These two bills will be introduced in the legislature prior to the closing of the present 30-day session, considered in committee, and have a fair hearing by everybody interested with good prospect of passage of one of them, which may be amended to meet the desires and requirements of the oil producers. The bill for state control, drawn by Mr. McLaughlin and presented by the state mineralogist, with possible revision and some moderate amendments, is probably the best and surest solution of the problem that has yet been offered in the legislature or out. There have been bills proposed which practically met with complete endorsement of the majority of oil producers, but they were not such bills as would stand judicial investigation. The present bill for state control contemplates minor changes in the conduct and operation of the state mining bureau and coöperation, so far as the oil industry is concerned, with the U. S. Bureau of Mines.

DENVER—Jan. 21

The Liberty Bell has lost its appeal to the Colorado supreme court in the case of the Moorhead Mining & Milling Co. which won a suit for trespass in a lower court. The decree granted the Moorhead company damages amounting to $46,072, for removal of ore from its property. Some time ago, the Liberty Bell lost a similar suit instituted by the Smuggler-Union.

Carnotite prospecting and mining in the western part of the state is at a standstill. Charges are made by prospectors that there exists a so called radium trust which controls the purchase and marketing of such ores. They contend that the Federal government should establish plants to purchase and treat their ores much upon the plan followed in Austria. The work that has been under way for a year or more by the Denver branch of the U. S. Bureau of Mines is in line with the desires of these complainants. The bureau has a plant in which it can handle reasonable amounts of ore but it was built primarily for research work rather than commercial purposes.

BUTTE—Jan. 21

St. Paul Electrification Contract is one of the most important ever placed, according to reports. The contract which General Electric has taken calls for electric locomotives, substation apparatus and line material. Transmission lines covering 113 miles between Three Forks and Deer Lodge will comprise the initial work. There are to be four divisions to the work, which when finished, will cover 440 miles with approximately 50 miles of track between Harlowton, Mont., and Avery, Ida. Ultimate plans provide for pushing this electrification forward from Harlowton to the coast, a distance of 850 miles. This St. Paul work is the first attempt to install and operate electric locomotives on tracks covering several engine divisions. Power will be supplied by the Montana Power Co., which has at present 68,890 kw. of developed power and further developments under construction of 175,000 kw. The power for electric operation has been contracted for by the railroad at a cost of a trifle over ½c. per kw.-hr. on the basis of a 60% load factor. The contract provides that the 440-mile electrification shall be in operation by Jan. 1, 1918. The system is to be direct current. General Electric figures submitted to the St. Paul show an estimated saving in operation equal to 20% on the total cost of electrification, without allowing for the increased capacity of the lines which electrification makes possible or for improvement of service. The estimated figures provide for an increase of 35% in tonnage per train and a saving of 27% in time per trip. The trolley construction will be of the catenary type similar to that which the New Haven has. Already 30 miles of poles have been set. The electric locomotives will be the most powerful of their kind ever built. They will weigh 260 tons and will have a greater continuous capacity than any steam locomotive now in existence. Nine freight and three passenger locomotives are provided in the initial order. The freight locomotives can handle a 2500-ton trailing load on a 1% grade at a speed of 16 miles and on heavier grades two locomotives will be used. These locomotives will require inspection only after a run of 2000 miles, require no stops for water, coal, dumping ashes, cleaning boilers and other delays demanded by the conventional steam locomotives.

SALT LAKE CITY—Jan. 21

The Keystone Mining Co. of Park City filed suit in the U. S. district court, Jan. 18, against the Kearns-Keith Mining Co., complaining of the removal of ore by alleged trespass. The complaint states that, until 1912, the Kearns-Keith conducted certain operations which resulted in trespass within the Red Fox and U. J. lodes of the Keystone Mining Co. It is stated that ore of an estimated value of $50,000 was removed.

SEATTLE—Jan. 20

The Ruby District business men's drilling campaign is not panning out well. Last summer a drill was purchased by some of the business men of the town who were anxious to have the creeks in the immediate vicinity prospected with the hope that pay would be found close to town. While their intentions were praiseworthy their method of handling the undertaking is said to have been a source of amusement to the old sour-doughs. Since the drill was placed on the ground there has been bickering and quarreling over who should handle it, so that to date nothing has been done and valuable time has been lost; there is still hope, however, of starting work before the winter is over.

In the Shoup Bay district constant mining development will be the order all winter. Reports from the Sealey-Davis mine state that the property is looking well. Good ore is being taken out steadily. The Three-In-One will resume work early in the spring, and the owners expect it to be a mine in a

little while. Extensive work will be done on the Gold Bluff, adjoining the Cliff, on the Shoup side of the hill. Little work has been done on this property for two or three years, because of litigation with the Cliff. This was settled a year ago and the Gold Bluff people proceeded with their applications for a patent, which will be issued soon, the final receipt for payment for the land having been received from the land office last fall. Work will be carried on practically all winter by the owners of the Cliff mine which is showing better than it has in some time.

In the Koyukuk, the showing is good in the old creeks and the mining outlook is all that could be expected. Pay has been uncovered on several of the older creeks, while prospects on others are fairly good. With the discovery of good pay on some of the worked-over ground renewed activity in prospecting is in evidence in the whole camp and before summer comes around it is expected something in the nature of a big strike will be made. A rich paystreak has been developed on Wild Creek according to the best information. About 40 men are working on both Wild and Jay Creeks now. On Jay, a tributary of Wild, pay has been located across six claims which average from $200 to $1000 per box-length. Portions of the creeks are difficult for winter mining owing to the fact that water running on bedrock floods the shafts, but the ground is so rich that many of the operators plan to work all winter.

The Tolovana Strike on Livengood Creek continues to attract attention. The scene of discovery is the center of a triangle of which the old camps of Fairbanks, Circle and Rampart (Hot Springs) are vertices. Roadhouses have been built along the trail from Fairbanks and a trading post started on Livengood. Little is known as yet regarding the value of the find, but the outlook is encouraging. The country rock is said to be limestone, gabbro, greenstone and serpentine. The gold is coarse and occurs irregularly in the gravel from top to bottom, the deepest shaft being down about 40 ft. without reaching bedrock. Shallower ground is found in other places. From claim No. 5 Below Livengood Creek, there is reported 9 ft. of gravel running 3c. per pan, $4 per cu.yd. On Ruth Creek, an opencut run 80 ft. into the bank disclosed 15 ft. of gravel at the inner face panning 1 to 3c. Good prospects are also reported from Mike Hess Creek and from all tributaries of Livengood heading in Amy Dome. Many prospectors are at work. Probably ground suitable for dredging, scraping or hydraulicking will be found, even if richer deposits are lacking. Knowles & McCord have leased eight claims on Livengood Creek with option to purchase for $45,000.

JOPLIN—Jan. 23

Better Prices for zinc ores in the Joplin district are leading the mine operators to prepare to take advantage of the high prices; they are rapidly bringing their plants up to full capacity, and as is usual in this district during times of prosperity there are a number of new properties being opened up and a number of drills dot the countryside. Considerable activity is noted within the areas of the sheet-ground deposits, especially around Webb City where a number of new leases have recently been taken on both old leases and new territory. With the coming of better weather these places should get into active operation at once.

An Extensive Pumping campaign is contemplated, involving the pumping out of all of the old ground lying east of Webb City and south of Carterville, covering the Missouri Zinc Fields tract, Homestead tract and a number of smaller tracts of ground; the object in view is that of mining not only the upper levels which have already been mined extensively but of opening up the lower sheet-ground levels which here have been mined only over small areas. The sheet-ground ore was mined when prices for zinc ore were around $30 and $35 per ton, too low for the successful operation of sheet-ground mines, except in a few instances where the orebodies were exceptionally rich, running 4 and 5% blende. With the present high price for zinc ores of $55 to $60, it is an easy matter to make sheet ground pay to operate even where the recovery is as low as 2½% blende. There are a number of sheet-ground properties throughout the district which will be opened up and operated again while the high prices prevail.

DULUTH—Jan. 23

The Inland Steel Co. has this week taken over the Armour No. 1 and No. 2 mines on the North Range of the Cuyuna, and will assume control Feb. 1. These mines were formerly operated by the Rogers, Brown Ore Co. for the Iroquois Furnace Co. Both are underground properties but estimates are now being prepared for stripping No. 1, which lies immediately east of the Pennington pit. The Inland Steel has heretofore been operating the Thompson pit, immediately east of the two Armours. With one exception, the Croft, these two properties are the best on the Cuyuna range, as to both grade and tonnage, each body being estimated at upward of 7,000,000 tons. The Armour No. 2 has been and is operating steadily but No. 1 has not been producing since 1913. The Rogers, Brown company still controls and operates the Kennedy mine at Cuyuna, the pioneer producer of the range. It is understood that efforts are being made to dispose of this property, as well as the Meacham mine, adjoining the Thompson, which the company has carried for a number of years but which has not produced. Rogers, Brown recently surrendered its lease to the Iroquois mine on the Mesabi range, but still retains some small interests in the Michigan districts. Until recently the organization has suffered severely because of internal friction in the mining end of the operation. Last year President and Gen. Mgr. Chester D. Tripp and Supt. H. J. Kruse resigned. The company's Cuyuna range headquarters have been moved from Crosby to Cuyuna.

ISHPEMING—Jan. 23

The Vanadium Deposit in Baraga County is not highly spoken of in the report made by Assistant State Geologist Hopper. No evidence of the minerals endlichite and carnotite reported were found by him in the specimens collected at the time of his recent visit. No vein over 3 in. wide was seen. Actual conditions do not tally with published accounts.

GREENEVILLE, TENN.—Jan. 23

The New Railroad which is being surveyed to extend from Kingsport on the Clinchfield road to Newport on the Oliver road from Knoxville will make accessible many prospectively important deposits of iron and manganese ores and zinc, lead and barite. The road follows the first great valley west of the Smoky Range and runs generally northeast and southwest across Greene and Cooke Counties. The iron deposits in Cove Creek Basin which will be tapped by the new road were extensively mined in the early half of the last century, furnishing the ore for many charcoal forges, from which the excellent quality of Tennessee iron was made. These have all been idle since the early '70s. The iron deposits are similar genetically to those at Embreeville and in parts of southwestern Virginia. Zinc occurs along the new line with certain iron deposits and as replacement and breccia filling along crushing zones in the Knox dolomite as at Mascot, Tennessee, and near Knoxville. There has been practically no exploration or development of the zinc deposits. Formerly the barite deposits in parts of the area were worked but until recently this business has been languishing owing to the competition of the cheaply imported barite in the eastern markets of the United States. Now several local operators are preparing to mine and ship barite and users are offering to take good sized contracts at attractive rates for the best grades of the crude ore.

TORONTO—Jan. 23

Cobalt Output will be considerably curtailed for some time owing to the shortage of power caused by the dryness of the weather last fall. The Northern Ontario Light & Power Co. has notified the mine managers that beginning Jan. 25, every mill in camp must be closed down for one week in every four until the shortage is over. Some of the companies will close down for three weeks continuously so that they will have only one stoppage, others will close for a week at a time. Mining operations will be continued by those companies having auxiliary steam plants capable of supplying the deficiency. At present there is no fear of any power shortage in the Porcupine camp.

PRINCE RUPERT, B. C.—Jan. 18

The Rocher de Boule Copper Co., although closed down at present on account of the market, put in an active year of construction and development. A 250-hp. hydro-electric power plant with pipe line and dam was constructed, and a five-mile transmission line from the power plant to the mine. At the mine there was erected a small portable saw mill with a capacity of 5000 ft. b.m. per 10 hr., a 12-drill compressor, and a Leyner sharpener. The mine is using Leyner machines and did 1200 ft. of development work in 1914. For transportation a 4½-mile aërial tramway was put in, overcoming a difference in vertical elevation of 4500 ft., and a narrow-gage railroad 3000 ft. long was constructed to handle the ore from the mouth of the tunnel to the tramway. In addition there were built six miles of wagon road and three miles of mountain trail. Four sets of ore bins were erected along the tramway, and 25 miles of telephone and telegraph service were completed. At Price Rupert ore bins and a wharf are under construction to permit loading the steamers by gravity. The chalcopyrite and tetrahedrite ore runs about 10% in copper and carries a combined precious metal content of about $4. The veins are fissures in grano-diorite. The property is controlled by Butte interests, and is in charge of Daniel J. Williams. It is hoped to resume operations about April 1.

The Mining News

ALASKA

BEATTIE, BARETTE & HAMILTON, laymen on upper end of Hard Luck claim, upper Vault Creek, have found pay running $5 to $6 per sq.ft. Ground lies above Prest workings of last summer; supposed to be continuation of rich pay worked by Prest.

FRED STRUTHERS AND TONY BOGETTI have proved pay on Palmer Creek, tributary to Chena River, estimated to run over $1 per sq.ft. for width of 120 ft. Ground examined by H. R. Walters last spring for Chicago capitalists, who contemplated putting on scraping plant, but difficulty of transport and other causes led to surrender of options.

KUSKOKWIM RIVER channel through delta, practicable for navigation, announced by Secretary Redfield, as made by Captain Lukens of the Coast and Geodetic Survey. Kuskokwim second largest river of Alaska; valley offers exceedingly promising field for prospecting; headwaters tap Innoko-Iditarod district. New steamer lines to be established.

VALDEZ CREEK PLACER MINES reports shipping to property, of Keystone drill and Ingersoll-Rand compressor and drilling outfit. Compressor capacity 310 cu.ft. per min., to be driven by 58-hp. Pelton wheel. W. T. Soule, superintendent of transportation for company, to leave Seattle with freight Jan. 30. A. H. Bryant, operating superintendent, is purchasing next season's supplies in Seattle; expects to start hydraulicking in May, clean up in four months and hydraulic again until freeze-up. President Sias reports expenditures in 1914 and 1915 to date as follows: Purchasing Kain property $5500, Smith-Monahan property $56,750, sundry property expenses, $770; development, $56,685; equipment, $47,254; administration and supervision, $12,848; interest, $48,137. Cash in Bank of Cordova is $15,000.

READY BULLION (Treadwell)—Rich pocket of ore reported recently encountered. Miners have been working in rich ore for more than a week but extent of deposit yet unknown.

TEIKHELL GOLD MINING CO. (Valdez)—Several men running tunnel near Teikhell roadhouse. Driven to crosscut three veins. First cut at 103 ft. from entrance; assays showed $109.

CORDOVA MINING & DEVELOPMENT (Cordova)—Crew completed 42 ft. of tunnel in December according to report of Superintendent Thomas. Tunnel was started on stringer running diagonally toward main vein at point where it has 3 ft. of width. At face of tunnel stringer shows 8 ft. of good looking quartz.

ROSE GROUP (Valdez)—Development work started by H. Jaynes and W. Quitsch on Mineral Creek. Planned to drive tunnel 20 to 25 ft. and tap lead, which should be reached at depth of 50 ft. Rock from mine brought to Crawford stamp mill gave good returns. Owners intend to push development as fast as possible.

NOS. 1 AND 2 BELOW SUNDAY CREEK (Nome)—Strike of considerable importance reported made on these bench claims by Frank Rice and Charles Haering. Paystreak over 100 ft. in width carrying values of 1 to 25c. from grass roots down, developed and said to extend considerable distance along creek. Rice & Haering extracted $50 in three days with scant supply of water.

ARIZONA

Gila County

STRIKE started Jan. 11 among construction mechanics of Inspiration spread to miners of Inspiration, Miami and Old Dominion, who demanded restoration of wage scale existing before war cut. Latest reports state increase was granted and work was resumed Jan. 24. Strike lasted 12 days, from 1500 to 2000 men being affected. Said to have been one of cleanest and best conducted on record. Strikers provided peace committee, and there was not one quarrel or loud argument on streets of Miami.

CALIFORNIA

Amador County

MOUNTAIN KING AND QUEEN (Pine Grove)—Pine Grove Consolidated Mining Co. operating under purchase option is installing hoisting machinery.

PLYMOUTH CONSOLIDATED (Plymouth)—Average cost of mining and milling reported $2.40 per ton for November. While this is increase of 10c. per ton over October, it is lower than average cost of mining and milling Mother Lode ores, which is said to be $2.80. Modern methods largely accountable for reduction.

Butte County

DOUBLE EAGLE MINING CO (Chico)—Damage suit for $7500 and restitution of property, brought against J. D. Hubbard and others.

DOLLING GOLD MINING CO. (Angels Camp)—Thought mine will be reopened within short time. Development just before closing down disclosed good ore and evidence of persistence of orebodies.

Eldorado County

YELLOW JACKET (Placerville)—Working lease and bond obtained by Burr Evans on this lode claim in Weber Hill district for Judge James Dingevon, of Brooklyn, N. Y.

Nevada County

KENOSHA MINING CO. (Grass Valley)—Resumption of work contemplated. The 500-ft. shaft will be deepened and levels extended into new ground.

RED LEDGE (Washington)—Strike of ore reported. W. W. Meeks, manager, has done large amount of development work, including 1000 ft. of new tunnel.

CHEROKEE (Tuolumne)—Old 400-ft. tunnel cleaned out and will be advanced 400 ft. to connect with old shaft sunk in early days when this gravel mine was producer.

CALIFORNIA (Grass Valley)—J. W. Degelier has taken a bond on this property in Dead Man's Flat district. Reported bond is in interest of George Wingfield, of Nevada. Mine has been producer and it is believed production can be resumed.

Shasta County

RUSSELL PLACERS (Ione)—Prospecting with Keystone drills will be undertaken immediately by E. T. Wiltsee, of New York, who is represented by Fred Grotefend, of Redding. Ground bonded by Wiltsee is same that was worked for a short time with dry-land dredge by Porter and Thompson.

MAMMOTH (Kennett)—Smelting resumed in third furnace, which was closed down at beginning of war. Fifty additional men will be employed and operation of plant, extraction of ore and development will proceed practically on same basis as prior to curtailment of operations.

SUMMIT (French Gulch)—The 600-ft. crosscut tunnel will be completed about Mar. 1. Mine has been producer intermittently during past 20 years. Vein sought is about 2 ft. wide, carrying high-grade ore. Ten-stamp mill, electrically driven on adjoining ground will be operated under lease.

Trinity County

TRINITY ASBESTOS MINING CO. (Carrville)—H. T. Mecum, manager, will ask boards of supervisors of Shasta and Trinity Counties for appropriations toward building road from Carrville to Castella, an economic shipping station on Southern Pacific R.R. Distance is 50 miles in direct line, though longer distance must be covered by wagon road. Such road would provide outlet for entire Carrville district. Freight by wagon must now be hauled from Redding by way of Lewiston at approximate average rate of $2.50 per 100 lb. This company has recently expended $10,000 for machinery and $3000 for development of asbestos and will require short wagon haul to market the product economically.

COLORADO

Lake County

DAVIS (Leadville)—Shaft-sinking stopped at 150 ft. and drifting at 130 ft. developed iron ore carrying 7 oz. silver.

HOPE (Leadville)—W. B. Anderson reopening this old downtown mine and expects to find zinc-carbonate orebodies in 300-ft. level.

San Miguel County

LITTLE DORRITT (Telluride)—Main crosscut tunnel driven to develop this Bridal Basin property has advanced about 2000 ft., recently intersected Sherman vein at depth of about 400 ft. from surface. Vein 6 ft. wide, said to assay $40 a ton. W. Z. Kinney manager.

Teller County

LAST DOLLAR (Victor)—Rapp & Page, working under lease, have reopened this Bull Hill property famous some years ago and are sinking main shaft in good ore below 1250-ft. level.

IDAHO

INTERSTATE-CALLAHAN (Sunset)—New concentrator to be erected in spring, on South Fork of Cœur d'Alene River below Wallace. Exact location not yet determined. Survey and plans made for aërial tramway from mine to railroad, two miles distant. Present mill of 300 tons daily capacity not large enough to handle tonnage mine will be capable of producing hereafter. Water supply not sufficient to permit increased concentrating capacity at site of present concentrator.

BLACK BEAR (Frisco)—No. 2 raise has reached 200-ft. level and station cut to hanging wall shows 12 ft. of good concentrating ore. No. 1 raise 900 ft. from No. 2 also in ore and believed ore will be continuous between two raises. No. 1 raise was started directly beneath winze sunk on good ore from upper workings and has depth of 1100 ft. on vein. No 2 raise has depth of 1800 ft. Plans completed for erection of concentrating mill. Portal of tunnel excellently located only 120 ft. from railroad tracks and high enough to allow erection of mill between it and tracks.

HYPOTHEEK (Kingston)—Regular assessments of 1c. per share will be discontinued, as arrangements have been completed for sale of $200,000 bond issue. New electric station pump will be paid for out of this money. Pump will arrive in 10 days and will be installed at once on 900-ft. level. This will enable company to develop this level on which rich ore was recently discovered. Crew will be increased to 50 men. Ranch of T. S. Young 3½ miles from mine has been purchased for millsite. Ore will be carried from mine to mill by gravity tramway.

MICHIGAN

Copper

WINONA (Winona)—Daily rock production now 180 tons, handled at Trimountain mill of Copper Range. Change not made to reduce cost to Winona but because Calumet & Hecla subsidiary mill at Point Mills was needed for Isle Royale rock. Change in milling, while it saves in freight, does not in end save anything to Winona tributors, since there is difference of 13c. a ton in price charged for stamping.

TAMARACK (Calumet)—No present intention to resume operations at any shaft and none will be planned until copper reaches 15c., making it possible to operate with profit. Force of miners has started drift to connect No. 3 shaft with slope shaft of Red Jacket branch of Calumet & Hecla at 66 level. This provision necessary to provide proper ventilation for Tamarack when resumption does take place.

KEWEENAW (Calumet)—Shaft down to 1000 ft. and copper showing good at lowest point. Metal appears in form of solid globules. East side openings continue satisfactory. Further financing to continue exploration of Phœnix much mooted question here but New York capitalists are reported willing to assume burden on preferred stock basis. Suggested too that Keweenaw Central may be extended to Copper Harbor, extreme point on Keweenaw Peninsula, to develop Ashbed formation which drills showed to be valuable.

WHITE PINE (Ontonagon)—Prevalence of smallpox will not cause cessation of operations. Only a few cases found, and every precaution taken to prevent further spread of the disease so it will not be found necessary to quarantine camp. Calumet & Hecla has ordered vaccination of all employees at White Pine. Under contract must have things in shape to begin milling rock by May 1. If possible, mill is to start before that time, perhaps as early as Mar. 1, beginning with stamping of about 500 tons of rock daily. Mill will have capacity of 1000 tons, however. White Pine has large amount of rock, rich in copper, in stockpile ready to go to mill. Plant being assembled rapidly and work of installing equipment of electrical power plant which will supply both mill and mine-hoist is proceeding.

QUINCY (Hancock)—Company trying experiments with new drill which will probably bring about greater efficiency in underground work than anything introduced for rock breaking in recent years. Drill weighs 105 lb., breaks all records for speed of operation, ease in erection and taking down and for wear on steel. Said to be combination of Jackhamer and Holman features. In one experiment a machine cut 54 ft. in 4 hr. Nothing like this accomplished in mine before. Two pieces of steel can cut 8-ft. hole, something never accomplished with any other drilling machine. Ease with which machine is handled makes it additionally advantageous. Is now for footwall operation entirely; can be used to advantage in practically any kind of opening. Further experiments will be conducted before general adoption is recommended.

Iron

AMERICAN (Diorite)—Mine again working with normal force, to be increased as new places are opened underground. Shaft now in fine shape. Woodbury jigs installed in mill, replacing other type, better results being secured.

BRULE IRON MINING CO. (Iron River)—Company started Chatham mine; 150 men taken on. Nothing given out regarding reopening of Berkshire, owned by same company. With Rogers, Chicagon and Hiawatha, of Rogers, Brown Ore Co., opening first of coming month, there will be few unemployed in Iron River.

AMASA-PORTER (Crystal Falls)—Shaft being sunk has entered fine body of bessemer ore, not before known to exist. Drills had shown some bessemer, close to the nonbessemer, but it was not thought ore would be found where shaft is going down. Little bessemer has been mined in Crystal Falls district and discovery is considered important.

LAKE ANGELINE (Ishpeming)—All work stopped Jan. 16. No hoisting through shaft for several months; ore mined came from pocket under hill to south. There was no stocking room and ore mined had been loaded in cars until 140 were filled. Railroad then refused to permit use of more cars and mining had to cease. Ore left in workings will be taken out after navigation opens. Company will resume sinking at Iron Mountain Lake property about first of April. Work there stopped when shaft filled with water. New boilers will be installed, as those in use are too small.

MINNESOTA

ZENITH FURNACE CO. (Duluth)—Blast furnace resumed operations Jan. 21, with full crew of 175 men.

Cuyuna Range

IRON MOUNTAIN (Iron Mountain)—Two new boilers have arrived and will be installed at once. Ten carloads of ore being loaded for experimental test at Jones furnace, Marquette, Mich.

MERRIMAC MINING CO. (Crosby)—Company has taken option on lands immediately south of its Croft mine in Sec. 1, 46-29. Three drills will be put to work at once in endeavor to prove up extensions of its existing bessemer orebody.

ROWE (Riverton)—Company advises that capacity of concentrating plant will be approximately 3000 tons of cleaned ore per day. All contracts for machinery and equipment let; work on erection will start in spring. Plant will not be custom plant, treating Rowe ore only.

HILL CREST (Ironton)—Contract let to Cuyuna Range Power Co. for current for stripping operations; 250 hp. will be used to pump water from Blackhoof Lake and 300 hp. to force sand and water back into the lake. Hydraulic operations will be similar to those used at Rowe mine. Company's surface plant now being constructed.

CUYUNA-SULTANA (Ironton)—Several acres of this property, near Cuyuna-Mille Lacs mine, will be stripped as soon as weather permits. Orebody consists of high-manganese iron ore, and is first deposit of such material to be removed by pit operation in Cuyuna district. Company is stock company with shares in open market.

Mesabi Range

WHITESIDE (Buhl)—Activity on property indicates operations will begin soon.

MINORCA (Virginia)—Third shift of miners added, giving work to 40 more men.

BRUNT (Mountain Iron)—Twenty-five men put to work repairing in preparation for inauguration of mining.

MACE (Hibbing)—Operations resumed. Mine was shut down by Oliver company some time ago and is now part of holdings of Arthur company.

OLIVER IRON MINING CO. (McKinley)—Rich deposit of ore struck by Oliver company under small lake. Three drill operating on ice since winter set in. Number of other drills at work in vicinity.

MISSOURI-KANSAS-OKLAHOMA

C. C. YODER AND ASSOCIATES, of Neck City, Mo., have leased 20 acres and mill of Lawton Mining Co., at Lawton, Kan., and have organized new company; will operate the mine and plant. Mine one of best in district, adjoining H. L. & S., and Eastern Lead & Zinc Co. mines. Work will be pushed.

NEW WAGE SCALE will go into effect, Feb. 1, in Flat River district reducing present wages about to point prevailing before 1913 strike. Machinemen on one-man drills will get $2.75 per 8-hr. shift and on two-man drills, $2.40; shovelers, $2.40; drill back-hands, $2.15; firemen, $2.20; surface laborers, $1.75 for 9 hr.

E. L. ARTHUR LAND near Galena, Kan., fast coming to front as producer; in last six months several good mines have been opened up on tract which lay idle for several years. Recent operations struck good lead and zinc; other prospecting resulted in good strikes and now several mines on tract make good turn-ins each week. Dirt at present handled by hand jigs or sold in rough, but land owner expects to build concentrating plant.

CLIFFORD & CO. (Galena, Kan.)—Another good mine brought in on Boice land. Fifth mine struck on this property recently.

JOHN W. PATE MINING CO. (Galena, Kan.)—Company moving mill from Old Times lease on Illinois Lead & Zinc land to lease at Klondyke where it claims to have struck good run of zinc ore; will enlarge plant and replace some of old machinery with new, enabling it to handle more dirt at less expense. Company has been successful in operations.

MONTANA

Broadwater County

OHIO-KEATING (Radersburg) — Stockholders voted to make stock of company assessable in order to liquidate indebtedness and provide funds with which to construct concentrator. Enough ore of low grade stated to be in sight to warrant installation of concentrator of approximate capacity of 100 tons. Mine was closed last year. Many of largest stockholders reside in Butte.

Jefferson County

SUNLIGHT (Whitehall)—This group to be actively developed by Martin Schweren.

Granite County

NEW ELECTRIC PLANT at Maxville just completed. Test run proved entirely satisfactory. Number of mines in upper Flint Valley contemplate using this power; this will permit employment of more men than heretofore, cost of steam power being almost prohibitive.

Lewis and Clark County

HAWKEYE (Helena)—At this group of claims, lying inside city limits in southwestern part of Helena, under development by Helena Mining Bureau, Inc., ore assaying from $8 to $15, was struck in bottom of inclined shaft which is down 173 ft. Promises to develop into valuable deposit. Helena Mining Bureau was organized by Helena citizens a year ago for purpose of developing mineral resources of the district and Hawkeye was one of properties recommended by expert engineers as worth expenditure required for development.

Silver Bow County

NORTH BUTTE (Butte)—Current report that company had purchased 700 acres adjacent to East Butte, denied by company officials.

LEONARD (Butte)—Mine resumed operations Jan. 21, Gagnon and Original mines of Anaconda company which were kept running to maintain output will probably close down soon, since Badger State is now supplying ore.

BUTTE & SUPERIOR (Butte)—Janey flotation machine, installed last of December proved so successful that it is stated by company official that six or seven more will be installed immediately when it should be possible to maintain recovery of 95%. Tailings from Janey machine are cleanest the company ever had.

PILOT-BUTTE (Butte)—Drifting begun upon new vein recently cut on 1400-ft. level, 85 ft. north of shaft, with promising indications for considerable tonnage of ore. One foot of shipping rock, carrying about 6% copper, cut when vein was first opened. Width of this ore holding its own, with here and there bulge showing.

BUTTE & ZENITH (Butte)—Company proposes to resume sinking to 1000-ft. level as soon as metal conditions adjust themselves. Shaft now down 640 ft., two compartments to 460-ft. level and three compartments remaining distance. Pumps were left in shaft, and, although now submerged, believed no harm will be suffered because of heavy coating of oil and grease given machinery. Butte & Zenith plans to cut large station at 1000 level and install pumps of great capacity to care for heavy flow of water characteristic of country in which it is operating.

BUTTE-BALLAKLAVA (Butte)—Company started retimbering three-compartment shaft from 900- to 700-ft. level, which will require about two months; pending this, mining

operations practically will suspend. With shaft in repair company will be in position to increase production to 200 tons daily as compared with from 100 to 150 tons before war. Company for past two months has been shipping about 50 tons a day, principally in conjunction with development work. About 15 men employed. With shaft repairs out of the way, it is expected steps will be taken toward sinking shaft to 1800-ft. level. Shaft now down 1600 ft., with showing on that level greatly surpassing that on next level above, the 1400-ft.

NEVADA

Esmeralda County

LONE STAR (Goldfield)—Shaft on Lazy George claim enlarged from two compartments to three and 15-hp. gasoline hoist installed. With shaft down 200 ft., 75-hp. electric hoist will be installed.

Lander County

TIN STRIKE northeast of Battle Mountain reported. Stated both lode and stream tin found.

AUSTIN-DAKOTA (Austin)—East drift on 310-ft. level of incline shaft started; expected will cut downward extension of shipping-grade oreshoot opened on 225-ft. level. Crosscut will also be driven to Jack Pot vein, distance of 200 ft.

White Pine County

WILLOW CREEK GOLD MINING CO. (Willow Creek)—Shaft will be sunk 200 ft.; whim installed. Drifting on main vein under way.

NEW MEXICO

Dona Ana County

MEMPHIS MINE (Organ)—A 28% copper shoot encountered on drift of 50-ft. level under lease by A. Roos. Strike considered one of richest in recent years. Norval Welch shipping from other parts of Memphis.

Grant County

CHINO (Santa Rita)—Company now operating seven days per week but has not increased forces.

85 (Lordsburg)—Good tonnage of copper ore high in silica being shipped daily to C. & A. at Douglas and to El Paso. Former company has issued notice that no more custom ores will be purchased until further announcement.

EMPIRE ZINC (Hanover)—Work on two-compartment shaft on Thunderbolt claims being pushed. Concrete bridge being built over Hanover Gulch and Santa Fé tracks to site of concentrator west of railroad. Carbonate zinc ore shipments continue.

Sierra County

ANIMAS PEAK GOLD MINING CO. (Hillsboro)—Company has started sinking of double-compartment shaft opposite old Kelly shaft. Property formerly known as Hillsboro Consolidated. Planned to do extensive work in spring.

Socorro County

SOCORRO (Mogollon)—Reliable reports state company has turned down Pacific mine on which it held option for $250,000. Tramway was under construction from mine to Socorro mill and much development work had been done. Heavy snows continue in Mogollon Mountains; fuel oil running low.

ERNESTINE (Mogollon)—Deep exploration under way on Last Chance vein. On 5th level below main tunnel, 1200 ft. below apex of vein, drift has been run in orebody 170 ft. Ore 10 to 15 ft. wide where crosscut and above average in value. Drift commenced on 7th level 200 ft. deeper. Persistence of good values at depth attracting much attention.

OREGON

GLEESON DEVELOPMENT CO. (Granite)—Cyanide plant has started up and is said to be successful.

POWDER RIVER GOLD DREDGING CO. (Sumpter)—Force of men at work sinking prospecting shafts on the D. E. Richen tract near Sumpter.

GRANT PASS Commercial Club has appointed committee of mining men to look into matter of securing custom mill to treat ores from smaller mines near town. Survey of extent of ores blocked out and ready for mill will be made; thought money can be raised to install a mill soon.

BEACH MINING in Lincoln County attracting mining men. Beach well panned down and most of creeks running into ocean have camps of from two to six men. Good wages being made with shovel and sluice box and some making more than wages saving fine gold and platinum.

BLACK SAND discovery in Jefferson County reported along the Deschutes River. Deposits extensive, said to carry $2.40 in gold, same in platinum and about $2 in silver per ton. Six Portland men and one Nebraska man have completed investigations, filed locations and are ready to work property. Those associated are: W. H. Bard, C. W. Clapp, J. B. Rossman, Thomas Hart, C. F. A. Peck, Edward D. Whitney, all of Portland, and Charles W. Ryman, of Lincoln, Neb.

UTAH

Juab County

KNIGHT-CHRISTENSEN MILL (Silver City) — New rolls installed, and operations resumed Jan. 15.

CENTENNIAL-EUREKA (Eureka)—Development being done on gold ore opened on surface, 500 ft. above shaft house. Two tunnels being driven to reach vein.

MAY DAY (Eureka)—Preparations being made for resumption of shipments, as soon as development and connections are completed. Good tonnage of silver-lead ore opened.

YANKEE (Eureka)—Bunches of lead-silver ore cut in winze from lower Humbug tunnel level. Ore is west of old Humbug ore channel; hoped it is continuation of May Day oreshoot. If this proves case, it is predicted ore will be found in this zone in Uncle Sam, Beck Tunnel, and Utah Consolidated properties.

DRAGON CONSOLIDATED (Silver City)—Ore carrying gold being mined in north end, through Iron Blossom. This comes largely from 600 level. Silver-copper ore also being produced. Diamond-drill work will be started to prospect Dragon ground from 1900 level of Iron Blossom, as soon as station can be cut.

Piute County

WEDGE GOLD MINING & MILLING (Marysvale)—Lessees recently made strike of ore running well in gold and silver at this property in Horse Heaven country. Ore was found in tunnel about 85 ft. from surface, richest portion occurring on footwall side of 10-ft. vein, where streak 18 to 20 in. wide runs high in gold. Boulders of quartz carrying free gold were broken and shipped from this property in early days, but rock in place was not found.

Salt Lake County

OHIO COPPER (Bingham)—Labor claims against company reported settled, as result of sales of copper, stored and in transit.

CARDIFF (Salt Lake)—Raise on orebody now up 113 ft. Is to be continued to make connection with upper tunnel for better ventilation; 287 ft. still to be driven.

Summit County

DALY-JUDGE (Park City)—Zinc concentrates amounting to 500 tons or more monthly being shipped. These average about 45% zinc. Most of ore, both lead and zinc, comes from between 500- and 1200-ft. levels. Recent development has opened largest tonnage in history of company.

SNAKE CREEK TUNNEL (Park City)—During December number of water courses cut, which added 2 sec.-ft. to flow at portal, bringing this to about 11 sec.-ft. Tunnel has cut diorite, which showed traces of iron, lead, and copper along contact. During December 296 ft. progress was made. New compressor installed. Length at present more than 10,448 ft.

Tooele County

BEN HARRISON (Stockton)—New Stockton Mining Co.'s lease on this property recently turned over to Mills & Campbell. Most of work done on 200- and 500-ft. levels. Ore carries lead, silver, and gold.

BUFFALO CONSOLIDATED (Ophir)—Crosscut tunnel being driven by lessees to reach ore zone at 200-300 ft. Ore opened for 100 ft. at higher level, and appears to extend to greater depth. Carries silver, lead and some gold.

CANADA

Ontario

JUPITER (Schumacher)—Reported under option to Crown Reserve.

NIPISSING (Cobalt)—Statement as of Jan. 2 shows cash and bullion on hand amounting to $1,396,788, compared with $1,270,026 for the same date of 1914.

TEMISKAMING (Cobalt)—New vein which comes in from Beaver on 530-ft. level followed for 40 ft., still good in face and 5 in. wide. Has yielded over nine tons of ore and wall rock is good milling ore.

VIPOND (Schumacher)—Annual statement to be issued about Feb. 15 will show about 16,000 tons of ore milled up to Jan. 1 and production in neighborhood of $90,000. Stated 40,000 tons of ore in sight above 300-ft. level.

TOUGH OAKES (Kirkland Lake)—New mill complete with exception of assembling some minor parts of machinery. Expected to be in running order by end of March. There are 7000 tons of ore on dump. Underground work suspended last summer was resumed Jan. 18.

LA ROSE (Cobalt)—Quarterly report shows dividend amounting to $187,000 was paid out of accumulated surplus. Cash surplus of Jan. 1 was $985,892 and total surplus $1,214,400, as compared with cash surplus $1,224,453, and total $1,396,619 on Oct. 1.

CROWN RESERVE (Cobalt)—Annual statement will show decrease of about 250,000 oz. in output, which remains approximately 1,500,000 oz. Of this only few thousand came from Carson vein which is about worked out. Porcupine Crown production for year is $667,000, of which about half is profit. Drummond Fraction operated jointly by Crown Reserve and Kerr Lake has done little more than pay for development.

HOLLINGER (Timmins)—Balance sheet to be presented at annual meeting in Montreal Feb. 2, shows profits for year amounting to $1,786,679, amount paid in dividends $1,170,000. Sum of $1,126,743 carried forward to profit and loss account. Bullion assets given as $204,861 and current assets, $603,632. New electric hoist ordered to handle increased tonnage required when 80 stamps go into operation.

MEXICO

Hidalgo

SANTA GERTRUDIS (Pachuca)—Reported in London new vein has been cut by crosscut; at point of cutting 10 ft. wide, running 19 oz. silver, $1 in gold. Drift for 48 ft. assays 57 oz. silver, $4 in gold. Found on 16 level, 870 ft. east of San Guillermo shaft, 700 ft. south of north vein.

AFRICA

Transvaal

CORRECTED RETURN GOLD PRODUCTION in Transvaal in December is 695,137 oz. fine gold, compared with 715,836 in November, and 672,815 in December, 1913. For year ended Dec. 31 total was 8,794,824 oz. in 1913, and 8,378,139 oz.—or $173,176,133—in 1914; decrease of 416,685 oz. Number of native laborers employed at end of December was 173,354, decreased of 1665.

The Market Report

Metal Markets

NEW YORK—Jan. 27

Copper and spelter, especially the latter, were widely excited during the last week and exhibit sharp rises in price. Lead and tin were a little stronger in sympathy with the other metals.

Copper, Tin, Lead and Zinc

Copper—The price rose steadily from beginning to end of the week, the market being at about 13⅞@14c., regular terms, on the first day, and at 14⅜@14½c., regular terms, on the last. In the aggregate a large business was done. Substantial sales to domestic wiredrawers were considered to reflect an improvement in domestic consumption. To the larger extent, however, the business continued to be in copper destined directly or indirectly for export, and in a large measure for military consumption. There were very large sales for export, although it is hard to understand where so much metal will be used, or in what form.

Indeed, the copper market for a month back has exhibited mysterious features. During the last week there were again peculiar inquiries, such as one for seven million pounds and another for 25 million pounds. Such inquiries coming from unusual quarters enhanced the mystery of the situation. There is a shrewd suspicion that some of the large transactions heretofore reported have simply been margined, delivery to be accepted after the termination of the war.

London reports buying there for governmental purposes only, with the London market closely following New York. American dealers are said to have been buyers of Standard copper.

The unfavorable statistics computed by an important consumer of copper attracted more attention from the daily papers and in Wall Street than they did in the producers' offices. The estimate of the large stock on hand was based on a guess respecting the consumption, while there were also some guesses as to production and exports. The producers have been reporting for some time past that their stocks of refined copper were shrinking. The recent behavior of the market is confirmatory of their statements. Certain of the smaller interests this week reported themselves sold out of copper for prompt and near-by delivery, but made sales of distant futures. In this connnection it is noteworthy that copper for distant deliveries has been sold at figures materially below current prices. We heard from one quarter of sales for delivery up to the end of September; and in another quarter, of sales of July-October contracts.

Exports of copper for the week ended Jan. 16 are reported by the Department of Commerce at 7,836,759 lb. Imports were 1,177,089 lb. metal and 1,891,381 lb. in ore and matte; 3,068,470 lb. in all. The larger exports were 3,755,479 lb. to France and 3,064,871 lb. to Great Britain; larger imports, 989,845 lb. from Peru, 840,000 lb. from Cuba, 725,381 lb. from Canada and 500,944 lb. from Chile.

Copper sheets were advanced ¼c. on Jan. 21, and again ½c. on Jan. 25, making the base price now 19½c. per lb. for hot rolled and 20½c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 15¼@15¾c., carload lots at mill.

Brass Prices, base, announced by the American Brass Co., as follows to date from Jan. 25, showing an advance of about ½c., are: Sheets, high brass, 16c. net per lb.; low brass, 17⅝c. Wire, high brass, 15¾c.; low brass, 17⅝c. Rods, high brass, 15¾c.; low brass, 18⅜c. Tubes, both brazed and open seam, 19¾c. Angles and channels, 19¾c. Scrap allowances are 0½c. net per lb. for high brass; 11⅝c. for low brass.

Tin—This metal has been stronger in sympathy with the others, but business was light.

Tin production of the Federated Malay States in December was 63,206 pikuls. For the year ended Dec. 31 the total was 50,147 long tons in 1913, and 48,157 tons in 1914; decrease, 1990 tons.

Tin ore receipts in Great Britain in December are reported by H. A. Watson & Co., Liverpool, as follows: Bolivia, 422 tons concentrate, containing 253 tons tin; Nigeria, 421 tons, equal to 295 tons tin; South Africa, 60 tons, equal to 42 tons tin; total, 903 tons concentrates, containing 590 tons tin.

Lead—Right at the beginning of the week an important domestic demand developed and a round tonnage was turned over on the basis of 3.50c., St. Louis. A rather large business for export was also reported. This led to a slight stiffening of price, and at the close, 3.55c., St. Louis, was asked by some sellers. The New York price of the A. S. & R. Co. remained at 3.70c., but some outsiders were asking 3.72½c., and the latter price was in fact reported realized on some small business. There does not appear to be any great confidence in lead, which is regarded as supported only by sympathy with the other metals and the continued large export business.

Spelter—The spelter market was excited and crazy, and is extremely hard to quote with accuracy. The price rose by leaps and bounds from day to day, and transactions reflect a highly confused situation. The total business done represented a large tonnage.

DAILY PRICES OF METALS IN NEW YORK

Jan.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
			13.70		3.67½	3.47½	6.47½	6.30
21	4.8395	48⅞	@13.85	34¾	@3.70	@3.52½	@6.67½	@6.50
			13.85		3.67½	3.50	6.62½	6.45
22	4.8400	48½	@13.95	35	@3.70	@3.52½	@6.92½	@6.75
			13.90		3.67½	3.50	6.67½	6.50
23	4.8425	48¾	@14.00	35	@3.70	@3.52½	@6.92½	@6.75
			14.00		3.67½	3.50	6.80	6.62½
25	4.8413	48⅞	@14.10	35¾	@3.70	@3.52½	@7.17½	@7.00
			14.15			3.50	6.92½	6.75
26	4.8438	48⅞	@14.25	35½	3.70	@3.55	@7.30	@7.12½
			14.20			3.50	7.05	6.87½
27	4.8513	48¾	@14.30	35	3.70	@3.55	@7.30	@7.12½

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c

LONDON

Jan.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
21	22¼	61⅞	13.44	62	....	158	150¾	18½	4.02	32	6 95
22	22⅛	62⅝	13.61	62¾	66¾	160	152	18¼	3.97	32½	7.06
23	22 11/16	....	....	....	....	....	....	....	....	....	....
25	22⅜	63⅜	13.77	63½	....	165	155	18⅜	3 99	33	7.17
26	22⅜	63¼	13.74	63½	67¾	165	157	18⅜	3 99	33½	7.28
27	22⅜	63⅜	13.77	63⅛	....	167½	166	18⅜	3.99	34½	7.50

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6 52c.; £60 = 13.05c Variations, £1 = 0.21¾c.

The facts seem to be that the unsold stock of spelter on hand at the beginning of January has been exhausted and smelters have become practically sold out for spot, prompt and near-by deliveries. In the present situation, March is considered a near-by delivery. On the other hand, domestic consumers are slow about entering into contracts for later deliveries. However, one large block for April-June was sold for export, and several large blocks for April and later. Prices largely below the prices for prompt and near-by were accepted.

The wide range of price from day to day reflects the current confusion, the differences in times of delivery and also differences in grades of metal heretofore unrecognized. Prime Western spelter guaranteed a trifle better than the standard was sold at substantial premiums over the ordinary. Brass specials and intermediates were sold during he last week at extravagant prices, far above anything yet mentioned.

Base price of zinc sheets is now $9 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

Other Metals

Aluminum remains in moderate demand, and the market shows no change of importance. Current quotations are 18¾ @19¼c. per lb. for No. 1 ingots, New York—**Antimony** continues in demand and prices are advancing, under the general apprehension of short supplies. Ordinary brands are higher, selling at 16.50@17.50c. per lb. Cookson's is scarce and 19@ 20c. per lb. is named—**Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. higher—**Quicksilver** is active and inclined to be stronger. New York price is $52 for flask of 75 lb., with $53@54 asked for small lots. San Francisco, $51@52 for domestic business. London price is £11 10s. per flask.

Gold, Silver and Platinum

Gold movement in the United States for the year ended Dec. 31 is reported as below by the Department of Commerce:

	1912	1913	1914
Exports	$47,424,842	$91,798,610	$222,616,156
Imports	66,548,772	63,704,832	57,387,741
Excess	Imp. $19,123,930	Exp. $28,093,778	Exp.$165,228,415

The heavy exports this year were due to the altogether exceptional conditions brought on by the war.

The gold pool of $100,000,000 formed some time ago to regulate foreign exchange has been dissolved, and the money will be returned to the subscribing banks.

Platinum is still quiet and rather depressed, with light demand and sales. Prices show more range than usual; $38@43 per oz. is asked for refined platinum, and $46@49 for hard metal, according to quality.

Silver has moved within narrow limits, without special feature, for the past week, closing steady at 22⅝d. in London.

Imports and Exports of Silver for the year ended Dec. 31 are valued by the Bureau of Commerce as below:

	1913	1914	Changes
Exports	$62,776,631	$57,603,438	D. $11,173,193
Imports	35,867,819	25,959,187	D. 9,908,632
Excess, exports	$26,908,812	$25,644,251	D. $1,264,561

The decrease in exports almost balanced that in imports; the latter was chiefly in the receipts from Mexico. In quantities the net exports were approximately 45,004,000 oz. in 1913, and 47,217,000 oz. in 1914; showing again of 2,213,000 oz. in quantities.

Zinc and Lead Ore Markets

JOPLIN, MO.—Jan. 23

Blende, high price, $61; assay base, 60% zinc, $51@58; metal base, 60% zinc, $49@52; calamine base, 40% zinc, $27@ 32; average, all grades of zinc, $48.40. Lead, high price, $50; base price, $47 per ton of 80% metal content; average, all grades of lead, $46 per ton.

A week of cold, the latter half of which ice covered the earth, together with an insufficient number of cars, reduced production and shipment of ores. Approximately 600 tons of the shipment is from reserve ore. There was no end of excitement in price making on Friday and Saturday, the base price being advanced from $55 on Thursday to $58 on Saturday.

SHIPMENTS, WEEK ENDED JAN. 23

	Blende	Calamine	Lead	Values
Totals this week	9,289,800	1,103,190	1,541,360	$286,940
Totals this year	40,923,020	3,465,720	5,480,400	1,181,350

Blende value, this week, $235,620; four weeks, $997,020.
Calamine value, the week, $15,840; four weeks, $47,950.
Lead value, the week, $35,480; four weeks, $136,380.

PLATTEVILLE, WIS.—Jan. 23

Following the sharp advance in spelter the base price of 60% zinc ore jumped to $56 per ton. The lead market is dull at $44 per ton for 80% lead ore.

SHIPMENTS, WEEK ENDED JAN. 23

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,417,050	60,000	331,700
Year	12,676,350	226,000	1,535,200

Shipped during week to separating plants—3,126,180 lb. zinc ore.

Iron Trade Review

NEW YORK—Jan. 27

While new business has been on a moderate scale, conditions continue to improve, and the steel mills are reported as operating between 50 and 60% of capacity. There is no rush, but a general increase of demand which is rather scattered but still quite appreciable.

The pig-iron market shows a better demand, mainly for moderate quantities, but increasing steadily. Both foundry and basic iron are called for.

United States Steel Corporation earnings for the fourth quarter are reported as below, the net earnings including surplus over operating expenses and ordinary renewals:

	1913	1914
October	$11,430,461	$5,580,533
November	7,392,166	2,798,388
December	4,213,722	2,554,249
Quarter	$23,036,349	$10,933,170
Subsidiary Co. charges, etc.		$4,587,912
Interest and sinking fund		5,777,081
Total charges		$10,364,993
Surplus for the quarter		$568,177
Dividend 1¾% on preferred		6,304,920
Deficit for the quarter		$5,736,743

Earnings for the quarter were the smallest reported for any quarter since the formation of the corporation. In view of this the directors decided to declare no dividend on the common stock for the quarter. The total net earnings for 1914 were $71,661,149, against $137,181,345 in 1913, and $108,-174,672 in 1912. The lowest earnings previously given were in 1904, when $73,176,522 was reported.

PITTSBURGH—Jan. 26

While the Steel Corporation's earnings past quarter were the lowest in the corporation's history, they have already started to increase, as January is showing heavier shipments, with naturally decreased manufacturing costs, and substantially unchanged realized prices. February is almost certain to see a further increase in shipments and a slight increase in average realized prices.

While steel orders are increasing only slowly, the market is making definite progress and there is less likelihood of setbacks than if there were more excitement. The railroads are buying more freely but are very reserved in discussing plans for future purchases, indicating perhaps that they do not wish the steel mills to stiffen their prices.

Last week the Carnegie Steel Co. reduced its pig iron stock by 21,000 tons and ordered into blast five additional furnaces, about all of which are now in, increasing the number in blast from 23 to 28, out of a total of 59. For several months most of the steel interests has been accumulating pig iron, so that a decided change in the operations of steel departments has undoubtedly occurred. The Carnegie company is understood to be operating more than 55% of its steel ingot capacity, against an average of 67% in 1914 and less than 40% in December.

Pig Iron—Buying of foundry is fair, in small lots widely scattered. Bessemer is inactive. We quote: Bessemer, $13.75; basic, $12.50; No. 2 foundry, $12.75@13.25; malleable, $12.75; gray forge, $12.50@12.75, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The market is very quiet. Some of the steel mills have signed the agreement offered by sellers of imported ferromanganese at the dictation of the British government, but it is not certain whether this will enable them to secure deliveries. The price remains nominally $68, Baltimore. Odd lots for shipment from stock can occasionally be picked up at $75@80.

Steel—The market is quiet, practically all the first quarter consumption having recently been put under contract at low prices. Mills continue to quote the advanced prices of $20 for billets and $20.50 for sheet bars, delivered Pittsburgh.

Assessments

Company	Delinq.	Sale	Amt.
Andes, Nev.	Jan. 5	Jan. 27	$0.03
Belcher Silver, Nev.	Feb. 8	Mar. 1	0.10
Blue Bull, Nev.	Jan. 4	Feb. 8	0.01
Booth, Nev.	Jan. 25	Mar. 1	0.02
Brunswick Con., Nev.	Feb. 16	Mar. 9	0.01
Carbonate, Ida.	Jan. 28	Feb. 28	0.001
Cash Boy, Nev.	Jan. 15	Feb. 15	0.005
Cedar-Talisman, Utah	Feb. 8	Mar. 1	0.005
Century, Utah	Jan. 2	Feb. 2	0.01
Clear Grit, Ida. (post.)	Feb. 9	Mar. 3	0.0015
Clearwater Con., Ida.	.....	Feb. 15	0.001
East Hercules, Ida.	Dec. 23	Jan. 15	0.01
Emerald, Utah (three instal.)	.....	June 9	0.01
Gethin Le Roy, Utah	Feb. 2	Feb. 23	0.02
Gypsy Qn., Nev.	Jan. 12	Feb. 16	0.01
Happy Day, Ida.	Dec. 24	Jan. 25	0.0025
Hypotheek, Ida.	Dec. 17	Jan. 29	0.006
Idaho-Nev., Ida.	Jan. 7	Feb. 1	0.001
Indiana, Mich.	Feb. 4	.....	1.00
Iron King, Ida.	Feb. 18	Mar. 19	0.001
King Pine Crk., Ida.	Feb. 12	Mar. 13	0.002
Laclede, Ida.	Jan. 12	Feb. 3	0.003
Lucky Friday, Ida.	Dec. 14	Feb. 11	0.003
MacNamara, Nev.	Jan. 12	Feb 3	0.03
Majestic-Idol, Nev.	Dec. 15	Jul. 20	0.005
Manhattan Con., Nev.	Feb. 30	Mar. 1	0.01
Moonlight, Ida.	Dec. 30	Jan. 28	0.005
Nabob, Ida.	Dec. 31	Jan. 25	0.005
Natl. Copper, Ida. (post.)	.....	Jan. 29	0.002
Nor. Bnkr. Hill, Ida.	Jan. 30	Mar. 6	0.002
Ophir, Nev.	Feb. 11	Mar. 5	0.10
Oreano, Ida.	Dec. 26	Jan. 25	0.00075
Phoenix, Ida. (post.)	Dec. 26	Jan. 26	0.005
Potosi, Nev.	Jan. 12	Feb. 4	0.02
Raven, Ida.	Dec. 30	Jan. 30	0.0003
Reindeer-Queen, Ida.	Feb. 15	Mar. 8	0.003
Rescue-Eula, Nev.	Feb. 11	Mar. 22	0.01
Scranton Ex., Utah	Jan. 4	Feb. 5	0.00025
Sheba, Utah	Jan. 12	Feb. 24	0.05
Sierra Nevada, Nev.	Feb. 8	Mar. 2	0.05
Silver Star, Ida.	Jan. 5	Feb. 5	0.002
Sunset Dev., Ida.	Jan. 18	Feb. 18	0.0025
Syndicate, Ida. (post.)	.....	Jan. 28	0.001
Tarbox, Ida.	Jan. 28	Feb. 28	0.0025
Ton. Gip. Qn., Nev.	Jan. 12	Feb. 16	0.01
Umatilla, Nev.	Jan. 4	Feb. 8	0.01
Union Con., Nev.	Jan. 14	Feb. 4	0.05
Utah-Yerington, Nev.	Jan. 2	Jan. 23	0.0006
Verde May, Ida.	Feb. 1	Mar. 1	0 001

Stock Quotations

COLO. SPRINGS	Jan. 26	SALT LAKE	Jan. 26
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.05½	Beck Tunnel	.06½
Cripple Cr'k Con.	‡.01½	Black Jack	.07
C. K. & N.	.04½	Colorado Mining	.09
Doctor Jack Pot.	.10	Crown Point	.01½
Elkton Con.	.48½	Daly-Judge	4.87½
El Paso	1.25	Gold Chain	.09½
Findlay	.02½	Grand Central	.64
Gold Dollar	.04	Iron Blossom	.95
Gold Sovereign	.04½	Little Bell	.10
Isabella	.17	Lower Mammoth	.04½
Jack Pot	.08	Mason Valley	1.00
Jennie Sample	.03	May Day	.13½
Jerry Johnson	.03½	Opohongo	.01
Lexington	‡.009	Prince Con	.22
Old Gold	‡.01	Seven Troughs	.02½
Mary McKinney	.33	Silver King Coal'n	2.60
Pharmacist	.01½	Silver King Con.	1.92½
Portland	1.17½	Sioux Con.	.02½
Raven B. H.	.03½	Uncle Sam	.05½
Vindicator	1.30	Yankee	.05

TORONTO	Jan. 26		
Bailey	.01½	Dome Exten	.07
City of Cobalt	‡.30	Foley O'Brien	.15
Coniagas	5.40	Hollinger	22.50
Peterson Lake	.25	Imperial	.01
Right of Way	.02	Jupiter	.10½
Seneca Superior	.75	McIntyre	.25
T. & Hudson Bay	30.00	Pearl Lake	.03
Timiskaming	.17	Porcu. Gold	.07
Wettlaufer-Lor.	.04	Preston E. D.	.01
Big Dome	6.25	Rea	.17

SAN FRANCISCO	Jan. 26		
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.04	Belmont	4.25
Belcher	.31	Jim Butler	.72
Best & Belcher	.06	Lone Star	.09½
Caledonia	.30	MacNamara	.03
Challenge Con.	‡.05	Midway	.07
Confidence	‡.10	Mont.-Tonopah	.32
Con. Virginia	.08	North Star	.14
Crown Point (Nev.)	.01	Rescue Eula	.06
Gould & Curry	.03	West End Con.	.54
Hale & Norcross	.05	Atlanta	.36
Julia	‡.01	Booth	.28
Mexican	.47	C.O.D. Con	.07
Occidental	.45	Comb. Frac	.08
Ophir	.07	Jumbo Extension	1.12½
Overman	.14	Pitts.-Silver Peak	.15
Potosi	.02	Round Mountain	.33
Savage	.04	Sandstorm Kendall	.10
Sierra Nevada	.07	Silver Pick	.09
Union Con.	.19	Central Eureka	‡.24
Yellow Jacket	.28	So. Eureka	‡2.25

N. Y. EXCH.	Jan. 26	BOSTON EXCH	Jan. 26
Name of Comp.	Clg.	Name of Comp.	Clg.
Amalgamated	57	Adventure	‡1½
Am.Sm.&Ref.,com	62½	Ahmeek	240
Am. Sm. & Ref., pf.	102½	Alaska Gold M	28½
Am. Sm. Sec., pf. B.	‡78	Algomah	‡.50
Anaconda	27⅛	Allouez	36½
Batopilas Min.	⅛	Am. Zinc	20
Bethlehem Steel, pf.	103½	Ariz. Com., ctfs.	4⅛
Chino	36½	Bonanza	‡.41
Colo. Fuel & Iron	26½	Butte-Ballaklava	‡2
Federal M. & S., pf.	29	Butte & Superior	44½
Great Nor., ore., ctf.	33½	Calumet & Ariz.	55
Guggen. Exp.	51½	Calumet & Hecla	370
Homestake	117	Centennial	16
Inspiration Con.	18½	Cliff	‡1
Mex. Petroleum	66½	Copper Range	32½
Miami Copper	19½	Daly West	2
Nat'l Lead, com.	47	East Butte	8½
National Lead, pf.	107½	Franklin	4½
Nev. Consol.	13	Granby	63½
Ontario Min.	2	Hancock	‡11½
Phelps Dodge	‡175	Helvetia	‡.25
Quicksilver, pf.	2½	Indiana	2½
Ray Con.	17⅛	Island Cr'k, com.	46
Republic I&S, com.	21½	Island Cr'k, pfd.	‡87
Republic I&S, pf.	77	Isle Royale	19½
SlossSheffi'd, com.	25½	Keweenaw	‡2½
Sloss Sheffield, pf.	‡82	Lake	‡6½
Tennessee Copper	31	La Salle	3½
Utah Copper	54	Mass	‡3½
U. S. Steel, com.	51½	Mayflower	‡5½
U. S. Steel, pf.	108	Michigan	‡.50
		Mohawk	51½
N. Y. CURB	Jan. 26	New Arcadian	5½
Name of Comp.	Clg.	New Idria Quick	‡3½
Beaver Con.	.27	North Butte	23
Big Four	.08	North Lake	‡1½
Blue Bell	.05	Ojibway	‡.75
Braden Copper	6⅛	Old Colony	‡41½
B. C. Copper	‡.50	Old Dominion	‡43
Buffalo Mines	⅛	Osceola	66⅛
Can. Cop. Corpn.	1 1/16	Quincy	52
Can. G. & S.	.05	Santa Fe	1½
Caribou	.58	Shannon	4½
Chambers Ferland	.15	Shattuck-Ariz.	24
Con. Ariz. Sm.	⅛	Superior	25½
Coppermines Cons.	‡1½	Superior & Bost.	1½
Davis-Daly	.95	Tamarack	29½
Diam'field-Daisy	.09	Trinity	2½
Dia. Black B.	.04½	Tuolumne	.22
Ely Con.	‡.01	U. S. Smelting	21
Florence	.70	U. S. Smelt'g, pf.	39
Goldfield Con.	1⅛	Utah Apex	‡2½
Goldfield Merger	.37	Utah Con.	10
Greene Cananea	23½	Victoria	‡1⅛
Kerr Lake	5	Winona	1½
La Rose	⅛	Wolverine	36
McKinley-Dar-Sa	.53	Wyandot	‡.50
Mines of Am.	2⅛		
Mutual Min., pf.	‡2½	BOSTON CURB	Jan. 26
Nevada Hills	.35	Name of Comp.	Bid.
New Utah Bingham	‡1/16	Alvarado	.70
Nipissing Mines	5½	Bingham Mines	‡3⅛
Ohio Copper	.12	Boston Ely	.13
Oro	.14	Butte & Lon'n Dev.	.24
Pacific Smelt	1/32	Calaveras	.95
Stand'd Oil of N.J.	402	Calumet-Corbin	.17
Standard S. L.	1½	Chief Con.	.80
Stewart	1⅛	Corbin	‡1
Tonopah	7⅛	Cortez	.25
Tonopah Ex.	2⅛	Crown Reserve	.75
Tonopah Merger	.33	Eagle & Blue Bell	.90
Tularosa	.25	First Nat. Cop.	1 1/16
West End Ex.	.03	Houghton Copper	1⅛
Yukon Gold	2⅛	Iron Cap Cop., pf.	‡5
		Majestic	.15
LONDON	Jan. 14	Mexican Metals	.15
Alaska Tre'dwell	£7 17s 6d	Nevada-Douglas	.55
Camp Bird	0 7 0	New Baltic	1⅛
El Oro	0 9 0	Oneco	.70
Esperanza	0 7 6	Raven Copper	.07
Mexico Mines	4 5 0	Smokey Dev.	.10
Oroville	0 12 9	So. Lake	4⅛
Philippine Dr.	1 0 0	Tonopah Victor	‡.17
Santa Gert'dis	0 8 9	Trethewey	.14
Tomboy	1 5 0	United Verde Ext.	1 1/16
Tough Oakes	0 11 3		

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	.....	28.983	26.553	.....
February	61.642	57.506	.....	28.357	26.573	.....
March	57.870	58.067	.....	26.669	26.788	.....
April	59.490	58.519	.....	27.416	26.958	.....
May	60.361	58.175	.....	27.825	26.704	.....
June	58.990	56.471	.....	27.199	25.948	.....
July	58.721	54.678	.....	27.074	25.219	.....
August	59.293	54.344	.....	27.335	25.979	.....
September	60.640	53.290	.....	27.986	24.260	.....
October	60.793	50.654	.....	28.083	23.199	.....
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver: London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	.....	64.304	.....	69.488	.....
February	14.49	.....	65.259	.....	70.188	.....
March	14.131	.....	64.776	.....	69.170	.....
April	14.211	.....	64.747	.....	69.313	.....
May	13.99	.....	63.182	.....	67.786	.....
June	13.603	.....	61.336	.....	66.274	.....
July	13.223	.....	60.540	.....	64.955	.....
August	*	.....	‡	.....	‡	.....
September	*	.....	‡	.....	‡	.....
October	*	.....	‡	.....	‡	.....
November	11.739	.....	53.227	.....	*	.....
December	12.801	.....	56.841	.....	*	.....
Year	13.602	.....	61.524	.....	68.168	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	.....	171.905	.....
February	39.830	.....	181.556	.....
March	38.038	.....	173.619	.....
April	36.154	.....	163.963	.....
May	33.360	.....	150.702	.....
June	30.577	.....	138.321	.....
July	31.707	.....	142.517	.....
August	*	.....	‡	.....
September	32.675	.....	‡	.....
October	30.284	.....	‡	.....
November	33.304	.....	139.391	.....
December	33.601	.....	147.102	.....
Av. year	34.301	.....	156.564	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	.....	4.011	.....	19.665	.....
February	4.048	.....	3.937	.....	19.606	.....
March	3.970	.....	3.850	.....	19.651	.....
April	3.810	.....	3.688	.....	18.225	.....
May	3.900	.....	3.808	.....	18.503	.....
June	3.900	.....	3.810	.....	19.411	.....
July	3.891	.....	3.738	.....	19.051	.....
August	3.875	.....	3.715	.....	‡	.....
September	3.828	.....	3.658	.....	‡	.....
October	3.528	.....	3.384	.....	‡	.....
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	19.079	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	.....	5.112	.....	21.533	.....
February	5.377	.....	5.228	.....	21.413	.....
March	5.250	.....	5.100	.....	21.460	.....
April	5.113	.....	4.963	.....	21.569	.....
May	5.074	.....	4.924	.....	21.393	.....
June	5.000	.....	4.850	.....	21.345	.....
July	4.920	.....	4.770	.....	21.568	.....
August	5.568	.....	5.418	.....	‡	.....
September	5.380	.....	5.230	.....	‡	.....
October	4.909	.....	4.750	.....	‡	.....
November	5.112	.....	4.962	.....	25.016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	22.544	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	.....	$13.23	.....	$13.99	.....
February	15.06	.....	14.12	.....	14.08	.....
March	15.07	.....	13.94	.....	14.10	.....
April	14.90	.....	13.90	.....	14.13	.....
May	14.90	.....	13.90	.....	14.27	.....
June	14.90	.....	13.90	.....	13.96	.....
July	14.90	.....	13.90	.....	13.90	.....
August	14.90	.....	13.90	.....	14.08	.....
September	14.90	.....	13.90	.....	14.03	.....
October	14.84	.....	13.75	.....	13.97	.....
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....